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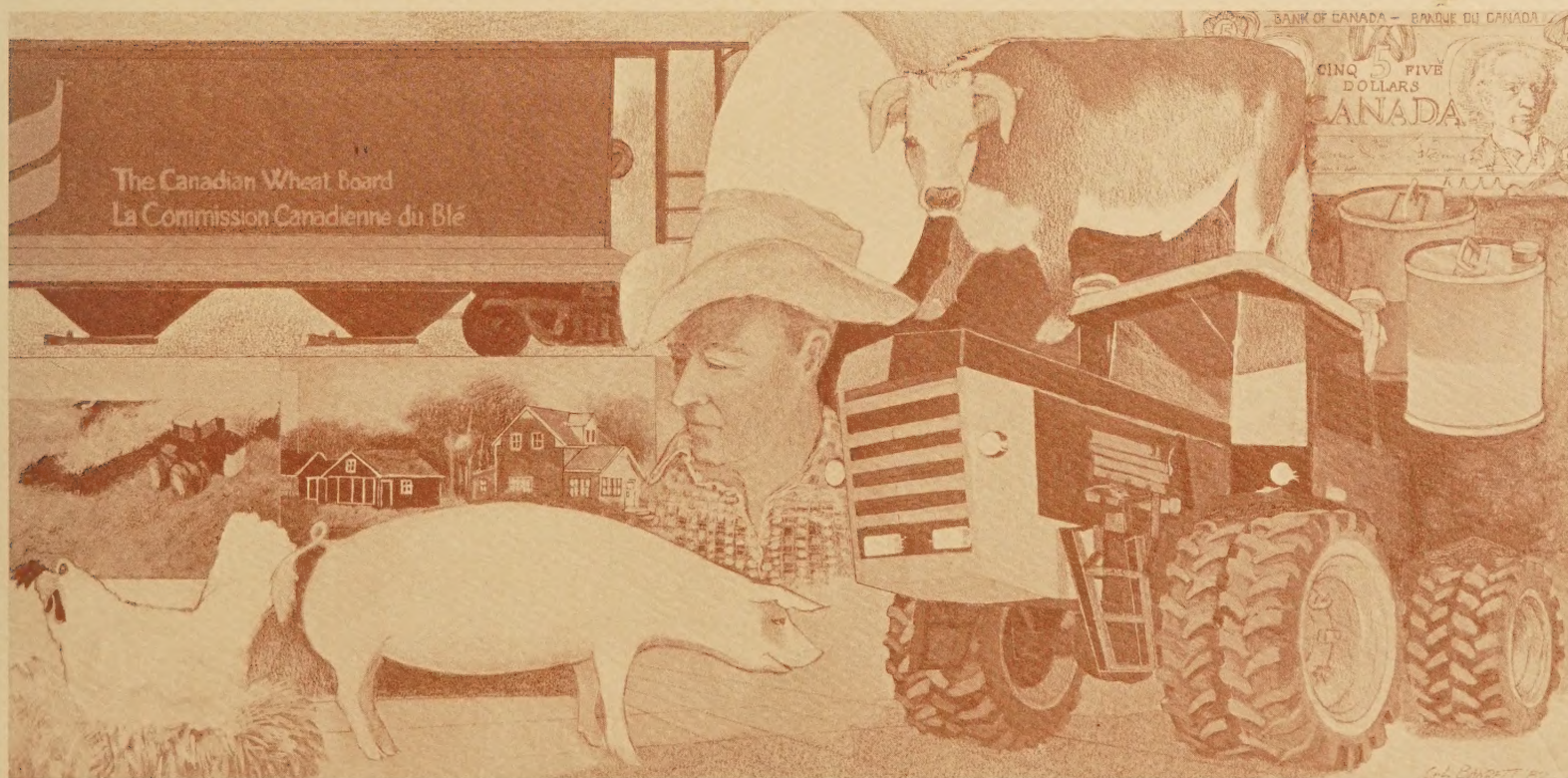
ECONOMICS OF AGRICULTURE IN ALBERTA: SELECTED ISSUES

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The Economics of Agriculture in Alberta: Selected Issues

July 1982

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PREFACE

In recent years, the Environment Council has become aware of a number of concerns about the long-term security of the agricultural land base. An in-depth look at the present status of the agricultural land base, and impacts that may affect the land base in the future, seemed warranted. Accordingly, the Environment Council is investigating this important topic.

Since settlement of this province began, farming and ranching have been important aspects of life in Alberta. Agricultural land dominates the landscape in central and southern Alberta, as rich farmlands appear to stretch to the horizon. Throughout the years, breaking of new farmland has continued at the fringes of settled areas, and land has been improved for agricultural use. The land base used for agriculture has increased, as have yields and production of crops. Agriculture is still an integral part of the social and economic fabric of Alberta.

In recent years, however, some concerns have been raised about the long-term security of the agricultural land base in Alberta. As the province grows, more land is needed for housing, transportation, and recreation. The amount of new land available for agriculture is limited. Resource extraction is expanding rapidly. Some farming practices, such as summer-fallowing, may be affecting soil fertility or land productivity. The acreage of land affected by salinization is increasing. Other activities, within or outside farming, are also having an impact on agriculture. The effects of each may be small, but evidence has been mounting that the cumulative effects may threaten the security of the agricultural land base itself.

In general, there appear to be three types of concerns:

- 1) loss and fragmentation of agricultural land
- 2) impacts on the capability of the land to produce agricultural products
- 3) impacts of other activities that influence the effectiveness and efficiency of agricultural activities.

The effects on agriculture can be direct, as in the loss of land, or indirect, as in the loss of service industries in a rural area. Some of these threats come from outside the agricultural industry, while others arise from agricultural activities and practices themselves.

The investigation will examine the types and magnitude of perceived threats to the security of the agricultural land base and will speculate on some implications for the future. Problems for agriculture will be identified and discussed in light of what is being done about them now and what could be done about them in the future.

A series of reports has been prepared for this investigation. Some of them present background information which sets the stage for further examination of the subject. Other reports look at the three types of concerns outlined earlier. These reports are intended to provide information to stimulate public discussion about the security of the agricultural land base. It is anticipated that public hearings on this topic will provide an opportunity for Albertans to air their concerns, confidence, pessimism, or optimism about agriculture in Alberta.

This study has been prepared to provide background information about several important and controversial economic issues facing agriculture. The report does not explain how or why agriculture in Alberta functions as an economic sector. Rather, the role of certain economic factors in the past, present, and future of agriculture in Alberta is explained, with particular emphasis on the importance of economics in determining the security of the agricultural land base.

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INTRODUCTION

The development of agriculture in Alberta was probably the single most important factor in the settlement of the province. The fur traders explored the area, the railways opened the prairies to settlers, but farmers built Alberta. Primary agricultural production made up over half of the total value of all production in the province until after World War II and continued to produce about one-quarter of the total value until 1965. Over half the residents of Alberta lived in rural areas until 1951 (Alberta Treasury 1980).

Industrialization and urbanization are recent phenomena in this province. Most Albertans are only one, or at most, two generations removed from farm life. However, for the three-quarters of the provincial population now residing in urban areas (1976 census), maintaining an understanding of agriculture may rely on media depictions, occasional visits, or parental descriptions, all of which can lead to romantic notions of farm life. Agriculture has changed and is changing. For most farmers, agriculture is still as much a way of life as a way of making a living, but business management skills are now an increasingly essential part of farm life. Large investments and high financial risks have arrived on the farm and are likely to stay.

Changes in the economic structure of agriculture in Alberta have resulted in both economic and political pressures within the industry. Farms are economic and political entities, as are all facets of our society, and thus the influence of these pressures on farmers must be considered along with physical parameters in any discussion of the future of agriculture in Alberta.

ECONOMIC PRESSURES: CAUSE AND EFFECT

The agricultural industry will be faced with many difficulties during the latter two decades of this century. Concepts such as the family farm and farming as a way of life are clearly in danger of being overwhelmed by economic conditions giving rise to corporate farms and agribusiness control. Small holdings (under 1000 acres for dryland grain production) farmed by a single family unit may be phased out during the present generation of farmers.

Some would say this is for the better — that progress demands the occasional termination of outmoded traditions, regardless of their romantic appeal. Others would argue that family farms are the core of our roots as a nation and that our basic values, perhaps our entire culture, would be undermined by a total commitment to the concept that bigger is better and more efficient down on the farm. There may be common ground and some compromise may be reached but, for the most part, resolution of this issue depends on the changing structure of the economy in Alberta, throughout Canada, and internationally. In the meantime, the agricultural community is uncertain of its future directions.

There are many economic issues contributing to the present state of uncertainty in the agricultural sector. One of the most important, product price variability, has long been the bane of prairie farmers. Much of Alberta's production is exported both to other areas of Canada and to international markets. Changing international demand for the type of commodity produced and the volume required affects the relative prices paid. Natural climatic conditions which produce bumper crops one year followed by drastic reductions the next directly affect product prices, especially for domestically consumed commodities. Changing consumer demand for certain products (for example, beef and oilseed products) has resulted

in price variability leading to shifts in agricultural production. Changes in provincial and federal government regulations affect all areas of agriculture to varying degrees. International trade barriers, erected by other countries and by our own, change economic conditions and thus product prices for the farmers of Alberta. Variations in any or all of these factors can and do have a substantial effect on the type of agricultural production in the province.

Economic uncertainty for farmers is also caused by the changing relationship between costs and product prices — rapidly rising input prices during the past 10 years have put many farmers in an ever-tightening cost/price squeeze. Skyrocketing petroleum and petroleum product prices (fertilizer, herbicides, etc.), double-digit inflation, the increasing cost of skilled farm labour, intensification of agricultural practices, and enormous increases in the cost of borrowing have led to a 260 percent increase in input costs over the 10 years prior to 1981.

Soaring land prices have outstripped other input prices by more than two to one (see Table 1). Land price increases have been partially attributed to many factors entirely external to the agricultural economy, further complicating the already uncertain outlook for agriculture. Other reasons behind the rise in land prices include all of those affecting the price of other inputs (see above). Recent increases in the price of agricultural land may carry with them an economic imperative to produce more per acre, which could result in agricultural practices detrimental to the soil.

Of course, factors other than the cost/price squeeze and product price variability are causing economic uncertainty in the agricultural community. Grain handling and transportation difficulties, and government responses to these problems, have been costly. One study estimated that over \$1 billion in deferred and lost sales during the 1977-1978 and 1978-1979 crop years were caused by an inability to move grain to export position (Alberta Agriculture 1980). Another calculated that government inaction on the controversial Crow rate issue is costing the Alberta livestock industry \$336 million per year (MacEachern 1978), while yet another contends that eliminating the rate would cost Saskatchewan grain producers \$721 million over a 25-year period (Anderson and Hendricks 1977). This is economic uncertainty on a large scale.

In addition, efforts to achieve regional and provincial self-sufficiency in several agricultural commodities have created serious distortions in the national market. Marketing boards with powers over supply and price have come under severe criticism for distorting natural locational advantages, erecting barriers to interprovincial and international trade, providing a disincentive to innovative efficient practices, raising consumer prices unnecessarily, and costing taxpayers and consumers more than \$1 billion per year (Josling 1981, Arcus 1981, Barichello 1981, Martin 1981, Plain and Hankedal 1981a, Haack et al. 1981, Loyns 1980). Regardless of the conclusions of these and other studies, tremendous uncertainty in the agricultural community must surely be one result of such criticism.

POLITICAL PRESSURES

The inevitable political truth is that producers are a small and diminishing minority in our society and that their economic and political strength has been weakening during the past

two decades. This trend may be levelling off or even reversing, but the primary farm production sector is relatively small, even in Alberta. Assuming the farm population in Alberta has remained constant from 1976 to the present after steadily declining since 1951, and that the Statistics Canada estimate of the total population of Alberta in the first quarter of 1981 is correct, the farm population comprises about 10 percent of the Alberta total (Alberta Treasury 1980 and 1981). Of course, this statistic may be misleading in a political sense. The rural — as opposed to farm resident — population of Alberta made up one-quarter of the total in 1976 (Alberta Treasury 1980).

Primary agricultural production contributed 6.2 percent of Alberta's total value of production, employed 8.5 percent of the provincial labour force, and provided 4.5 percent of the total personal income of the province during 1979 (Alberta Treasury 1980). Despite a 370 percent increase in cash receipts from farming between 1966 and 1979, the share of the total provincial value of production for primary agricultural production dropped from 23 percent of the total in 1965 to only 6.2 percent in 1979. In fact, during this period, the percent share of total value of production of *all* industrial sectors other than the mining, oil, and gas sector declined. The mining, oil, and gas sector of the provincial economy increased in value of production by 1728 percent during this period, dwarfing all other sectors in both rate of gain and total value, and contributed 56.9 percent of the total value of production in 1979 (Alberta Treasury 1980). Like the farm population figures, these calculations may be quite misleading. As recently as 1971, Alberta Agriculture estimated that 65 percent of the gross provincial product came from agriculture and agriculture-related industries such as the food and beverage industry (Alberta Agriculture n.d.). Assuming a decline in relative importance similar to that of primary agricultural production, agriculture-related activities still make up over 25 percent of the gross provincial product. In addition, these figures are relative to the total value of production in Alberta. It is not that the value of agricultural production has declined, it has simply not kept pace with the astonishing rate of increase in the oil, gas, and mining sector.

The oil, gas, and mining sector of the Alberta economy is based on non-renewable resources. As the resources decline in availability and the cost to extract them rises, the sector of the Alberta economy that is based upon them will also decline. On the other hand, agricultural production is based on a potentially renewable resource — the productive soil of Alberta's farmlands. It is of the utmost importance for the people of Alberta to recognize *now* that the conventional oil and gas industry will ultimately decline as the major factor in our economy and food production will re-emerge as one of the most important products in the province. As an anonymous bard once said:

*To get land's fruit in quantity
Takes jolts of labour ever more,
Hence food will grow like one, two, three...
While numbers grow like one, two, four...*

(quoted from Samuelson and Scott 1980:17)

The timing of the resurgence of basic agricultural production as the major factor in our economy is unimportant unless the resource is no longer available to future farmers. The long-term security of the agricultural land base is an insurance policy for the people of Alberta, but short-sighted exploitation or permanent removal of the resource from

production could lead to a serious reduction in the value of the insurance at a later date. While the political influence of Alberta farmers may be eclipsed by others now, we would do well to remember their interests, because ultimately, their interests are our interests.

IMPLICATIONS OF THE DIVERSITY OF AGRICULTURE IN ALBERTA

As the title implies, this publication deals with selected economic issues only. No attempt has been made to cover the entire spectrum of agricultural economics, how farmers make their living, or how they will in the future. The incredible diversity of the agricultural economy throughout Alberta would require an entire library of books to describe; indeed, there are libraries of material devoted to the subject. It must be noted at the onset that there is probably no such thing as an average farm in the entire province. There were over 60,000 census farms in Alberta in 1976; no two were just alike. Farms with cattle, for example, varied as to dairy or beef, feedlot or ranch, "inners and outers" or permanent livestock producers, cow-calf or finishing, those farms producing the bulk of their feedgrain and those purchasing all of it, farms located in the southern foothills and those on the prairie, those near markets and those remote from packing houses or milk processors. All of these factors and dozens more subtle interact to make each farm unique.

This report relies on statistics to make generalizations about the economics of farming in Alberta, but because of the diversity of farm types in the province, no farmer is likely to recognize his own operation in the discussion that follows. Statistics rely, for a proper portrayal of reality, on the "law of large numbers." This "law" states that with a normal distribution of occurrences, the larger the number of examples included, the more likely the accuracy of the conclusion. Care must be taken in drawing conclusions from the large numbers involved in agriculture in Alberta since the distributions (for example, of income) may not be "normal." In this case, normal means that on-farm income may not be distributed across farms in Alberta with relatively few farms in the lowest income categories, most in the middle income range, and relatively few in the highest categories.

One final note in interpreting this material: because farming practices vary so widely through the province, and because most of us are familiar with only certain types of agriculture, it is easy to fall victim to the "fallacy of composition." This rule of logic has been defined as follows: "a fallacy in which what is true of a part is, on that account alone, alleged to be also necessarily true of the whole" (Samuelson and Scott 1980:13). An example of this potential error might be the case of summerfallow, which for certain farmers in some parts of the province is correctly utilized every second or third year. Generalizing this practice to the province as a whole, on the other hand, could seriously harm the productive capacity of the soil and result in substantial financial losses to many farmers in other areas of the province.

THE VALUE OF AGRICULTURAL LAND IN ALBERTA

The price of agricultural land in Alberta has increased by over 1000 percent in the last 20 years (see Table 1). From an average of \$35 per acre in 1961, agricultural real estate has escalated to \$386 an acre in 1980. Between 1975 and 1980, land values rose 166 percent (Pei 1978, Miller 1981). However, these figures do not represent constant dollars; that is, inflation is not taken into consideration. When 1971 constant dollars are used, agricultural land values still rose by 175 percent from 1971 to 1980. By way of example, real increase in price would mean that an automobile priced at \$4000 in 1971 would cost \$8333 in 1980 in 1971 constant dollars, because of inflation. If the price of automobiles had increased at the same rate as the price of agricultural land, the equivalent automobile would cost \$14,580 in 1971 constant dollars by 1980. Ignoring constant dollars, if its price increased at the same rate as the price of agricultural land in Alberta, the car priced at \$4000 in 1971 would be priced at \$18,912 in 1980.

The above estimates should be taken as low since agricultural real estate has been defined for purposes of reporting in the Alberta Agriculture Real Estate Value Summary (Miller 1980) as having an upper limit value of \$1500 per acre. Thus any agricultural land selling for more than \$1500 is not included in the report as an agricultural sale. This upper limit may soon need adjusting, given the rate of increase in the price of agricultural real estate. For example, real estate transactions for class 1 soil in census division 13 (north of Edmonton) *averaged* \$930 per acre in 1980 (Miller 1981). Land selling for over \$1500 per acre would not be reported in this average value.

A second reason for considering reported values for agricultural land as low estimates is that these figures are taken from "assurance trust fund values." These values *"represent opinions of value in real estate transfer and primarily represent proxies for average market values. Individually, the figures cannot be assumed to reflect average market, productive, capitalized or economic value.* There is a definite tendency to reflect average values below the actual open market value" (Miller 1981:6; italics in original).

It is clear that land prices have escalated rapidly over the last several years, rising far faster than the rate of inflation. The question to be asked is: why? Why, in a period of dramatically increased input costs to agriculture, relatively flat unprocessed product prices, stable or decreasing economic productivity, and high interest rates, has the price of agricultural land continued to outstrip the rate of inflation?

FACTORS AFFECTING THE PRICE OF AGRICULTURAL LAND

Scarcity is often cited as the primary reason for high prices regardless of the product, and agricultural land in Alberta is a scarce commodity in an economic sense. The Canada Land Inventory (CLI) has classified only 1.23 percent of the total area of Alberta as class 1 land. Class 1 land is defined as that which has no significant limitations for crops adapted to the area. Class 2 and 3 lands have moderate to moderately severe limitations for growing crops adapted to the area and compose less than 16 percent of the provincial land base. Thus classes 1 to 3, which are often referred to as "prime" agricultural land, cover about 17 percent of the total area of Alberta. Class 4 land is considered to be marginal land for cultivation, with severe limitations that restrict the range of crops which can be grown, or require special conservation practices, or both. Class 4 land composes 15 percent of Alberta, making a total of 32 percent of the province suitable for cultivating crops other than tame

Table 1. Relative land, farm product, farm wages, and farm input prices

Year	Index of Land Prices (1961=100)	Index of Farm Prices for Agric. Products* (1961=100)	Index of Farm Wages (1961=100)	Index of Farm Input Prices (1961=100)	Ratio of Product to Input Prices	Ratio of Product to Land Prices
1961	100.0	100.0	100.0	100.0	100.0	100.0
1962	102.8	108.2	101.4	107.2	100.9	105.2
1963	111.1	105.4	102.9	110.6	95.3	94.9
1964	125.0	102.0	110.0	110.3	92.5	81.6
1965	147.2	106.0	111.4	114.1	92.9	72.0
1966	163.9	115.9	128.6	120.6	96.1	70.7
1967	194.4	113.8	131.4	121.6	93.6	58.5
1968	216.7	109.6	142.8	125.6	87.3	50.6
1969	213.9	112.5	157.1	130.2	86.4	52.6
1970	200.0	110.8	151.4	131.0	84.6	55.4
1971	197.2	110.8	164.3	135.9	81.5	56.2
1972	200.0	130.0	175.0	145.2	89.5	65.0
1973	225.0	205.6	192.9	162.9	126.2	91.4
1974	288.9	251.1	244.3	190.7	131.7	86.9
1975	352.8	239.3	288.0	224.6	106.6	67.8
1976	388.9	221.6	346.7	238.4	93.0	57.0
1977	791.7	213.8	381.7	251.0	85.2	27.0
1978	955.9	249.0	392.9	289.8	86.2	26.1
1979	1186.5	288.7	454.1	322.4	89.5	24.3

*The base year of the Index of Farm Prices for Agricultural Products and the Index of Farm Input Prices changed from 1961 to 1971 over the period of recorded observation. The indices were, therefore, spliced in order to develop a complete series of relative product-factor prices.

Sources:

"Price Index Numbers of Commodities and Services Used by Farmers", Dominion Bureau of Statistics, Ottawa, August issues, 1961-1970; "Farm Input Prices Index", Statistics Canada, Ottawa, 4th Quarter 1978 and 1979; "Index Numbers of Farm Prices of Agricultural Products", Statistics Canada, Ottawa, July 1978 and April 1980.

Land Price estimates from Alberta Agriculture, August 1980.

Table Source: Anderson and Associates 1981.

hay. Much of this land, especially the class 4 land in northwestern Alberta, has not been improved for cultivation. (For a complete description of the Canada Land Inventory, see Thompson 1981a.)

Class 1 to 3 land is not only scarce in Alberta, it is also located primarily in areas where competing non-agricultural uses are most prevalent. The Edmonton-Calgary corridor contains a very high proportion of class 1 to 3 land and land in this area is in great demand for urban and industrial expansion, rural subdivision, and transportation, energy, and communication networks. From 1977 through 1979, nearly 80,000 acres were approved or conditionally approved for non-agricultural subdivision in the Edmonton-Calgary corridor (regional planning commission areas of Edmonton, Battle River, Red Deer, and Calgary). An additional 51,000 acres were approved for annexation to urban municipalities in these regional planning commissions (Thompson 1981b). Projections of potential loss of land in Alberta to 2000 from the agricultural land base range from 700,000 to one million acres due to urban annexation, subdivision, and road transportation (Thompson 1982).

The difference in productivity between class 1 land and class 4 land is to some extent reflected in the average price per acre. During 1980, the average reported value of class 1 land was 2.2 times that of class 4 (Miller 1981). This price differential approximates the difference in productivity between class 1 and class 4 land (class 1 land being about twice as productive as class 4) (Thompson 1981a:17).

The relative scarcity of productive agricultural land in Canada and worldwide may have some upward influence on Alberta land prices, but the increasingly balkanized nature of Canadian agriculture probably has an influence as well. Ultimately, increasing world demand for Alberta agricultural products may induce higher agricultural land prices, but present indications are that intra-provincial pressures are for the most part responsible for the rapid rise in price.

Factors affecting the price of agricultural land other than relative scarcity both within Alberta and worldwide can be divided into two categories: those external to agriculture and those pressures stemming from within the agricultural sector. Factors considered to be external to agriculture include urbanization and near-urban price increases; linear developments' demand for land for purposes such as transportation and communication corridors, pipelines and transmission lines, etc.; foreign demand for agricultural land whether for alternative uses or continued farm production; and speculative buyers purchasing agricultural land for tax shelters, as a hedge against inflation, or for its future value in feeding the "starving masses" of the world.

Factors within the agricultural sector which tend to increase the price of land include increased prices for agricultural products, technological changes making larger farms more economic thus forcing up demand and price for land, increasing cost of inputs leading to more extensive agriculture, wheat quotas making larger land holdings beneficial for quota delivery purposes, marketing boards and interprovincial trade barriers which to a small extent increase demand for certain Alberta products within the province (while discouraging production of other products due to a lack of availability of export markets either to the rest of Canada or to the international market), and finally, economic distortions in the agricultural sector caused by government interventions, whether federal, provincial, or municipal.

FACTORS EXTERNAL TO AGRICULTURE

Urbanization, and perhaps more importantly, speculation regarding the future extension of urbanization has been responsible for much of the increase in the price of agricultural land. Agricultural land near large urban areas is usually the highest valued in the province. The two municipalities with the highest average agricultural land value in the province in 1980 were M.D. 44 surrounding Calgary at \$770 per acre and the County of Strathcona bordering Edmonton at \$750 per acre. The ten municipalities with the highest average price in Alberta during 1980 were all bordering or adjacent to municipalities surrounding Calgary, Lethbridge, Edmonton, or Red Deer (Miller 1981).

Real estate values near Edmonton and Calgary were examined in detail by Miller (1981). The results show that overall average value per acre in the Edmonton periphery was \$2905 in 1980, an increase over 1979 prices of nearly 13 percent as compared to a staggering 78 percent increase from 1978 to 1979. Per acre value in the Calgary periphery was \$2050 in 1980, up 28 percent from 1979 compared to a 51 percent increase between 1978 and 1979 (Miller 1981). The average value of agricultural real estate near Edmonton was 7.5 times the provincial average (\$385) while that near Calgary was 5.3 times the provincial average. The advantages of developing rural land for non-agricultural purposes were further illustrated by Miller (1981) where he showed that rural land transferred for non-agricultural purposes sold for an average price of \$4,395 per acre in 1980. Perhaps most significant, the price for parcels of land less than 5 acres averaged \$25,600 per acre in 1980 near Calgary and \$16,000 per acre near Edmonton. The price per acre was down from 1979 near both cities — from \$38,000 near Calgary and \$19,500 near Edmonton (Miller 1981).

It is not possible to determine the interplay of factors resulting in higher land values near urban areas (for example, subdivision for acreages, direct urban expansion, industrial expansion, speculation, etc.), but the connection is clear. In addition to the high prices for land directly adjacent to major urban centres, land in the relatively heavily populated Edmonton-Calgary corridor has also been high in price. Of the 66 municipalities in Alberta, with one exception, the 15 with the highest average price per acre are all located roughly within the Edmonton-Red Deer-Calgary corridor (Miller 1981). The exception is County 26 which surrounds Lethbridge, Alberta's third largest city. Another factor affecting the price of land in this area is irrigation. Transportation, energy-related developments (oil and gas pipelines and electric transmission lines), and communication lines may add to the land price pressures in the corridor area. In addition, the corridor encompasses some of Alberta's most productive agricultural land.

Another factor which may influence the price of land throughout the province is the so-called "ripple effect" caused by high prices in certain areas of the province. Farmers selling their land for very high prices near urban areas or within the Edmonton-Calgary corridor are able to bid up prices in other areas. The impact of farmer relocation on the price of agricultural land is nearly impossible to document, but it stands to reason that a producer receiving high prices for his land and not wishing to retire or move to an urban area can outbid beginning farmers or those requiring substantial credit for additional land purchases. This trend is enhanced by a roll-over clause in farm capital gains tax law whereby a farmer can sell his farm and buy a similar farm within one year without paying any capital gains tax. High interest rates exacerbate the problem since producers fortunate enough to receive high

prices for their land for reasons other than agricultural use can pay cash for land and escape the heavy interest burden. Of course, some new farmers are able to compete in the land market because of low interest credit available through federal and provincial farm loan programs.

Non-resident or foreign purchasers of agricultural land may also contribute to the rise in land prices. Alberta has no mechanisms for monitoring purchases of land by Canadians not resident in the province of Alberta. The attitude of the provincial government is apparently that a Canadian citizen has the right to own land and other assets throughout the country regardless of his present address. This attitude is in keeping with the spirit of nationhood, although some other provinces have erected barriers against Canadian landownership if the individuals are not resident in the province.

Purchase of land by foreigners constituted a fairly significant amount of the rural land sold in Alberta until the Alberta Government limited foreign acquisitions to twenty acres per buyer in 1977. In 1976-77, for example, 5.6 percent of the acreage of total rural sales went to foreigners. The percentage dropped to 0.2 during the 1978-80 period (Alberta Energy and Natural Resources 1980). The salient point is that the small amount of land acquired by foreigners was much better quality than average agricultural land and much higher than average prices were paid. During the 1979-80 fiscal year, 57 percent of the land purchased by foreigners was class 1 to 3 (only 17 percent of the province as a whole was so classed). Even more dramatic was the average price paid for this land: \$5558 per acre (Alberta Energy and Natural Resources 1980). This was over 14 times the average per acre price paid for agricultural real estate during 1980 (Miller 1981). Although foreign purchase of agricultural land in Alberta has been insignificant in terms of acreage since 1977, the price paid per acre has been extremely high. The extraordinary prices paid by foreigners illustrates the inadequacy of placing a \$1500 upper limit on the definition of agricultural land.

The purchase of agricultural land may occur as a hedge against inflation. As described earlier, rural land has increased in price at a much higher rate than inflation has eroded the dollar. Some investors may purchase land as insurance against further losses of the purchasing power of the dollar, then rent the land to recover some of the principal and use the land as a tax shelter for other income. The nature and extent of this practice is extremely difficult to document as is the impact, if any, on the price of agricultural land.

FACTORS INTERNAL TO AGRICULTURE

Changing Technology

One factor in the rise in value of agricultural land over the past 20 years has been a rapidly changing technology leading to larger farm operations because of the principle of economies of scale. Between 1961 and 1976, the number of farm operators in Alberta with over 1600 acres increased by 48 percent (Furtan and Thompson 1980). During the same period, the number of farms with less than 400 acres (small farms) decreased by 39 percent despite the apparent rise in hobby and part-time farms. (It would be arbitrary and perhaps quite misleading to differentiate between hobby, part-time, full-time, and tax shelter farms at the lower end of the scale of acreage and production. A census farm was defined in 1976 as one

with one acre or more with agricultural product sales of \$1,200 or more, hardly a self-supporting economic unit). The size of census farms in Alberta increased by about 27 percent between 1961 and 1976 to an average of 817 acres, but the number of farms under 760 acres decreased by over 33 percent (see Table 2) (Furtan and Thompson 1980). This is apparently one of those cases where "average" numbers are misleading. The trend is away from the central average point and toward greater numbers of very large farms and an increasing number of small census-defined farming operations with farms in the middle range decreasing substantially.

Several technological changes have created an economic environment leading to increased farm size. Large equipment and increased use of pesticides have led to economies of scale previously impossible. With larger equipment, more land can be cultivated in a shorter period of time. In addition, a producer may need to distribute the capital cost of larger machinery over a larger land base to keep the per acre cost of the machinery at a reasonable level. The use of herbicides can also reduce the per acre amount of time spent cultivating, allowing the producer to handle a much larger area. According to a recent study of farm size, "mechanical and chemical technology have been adopted faster than any other type of innovation causing major changes in farm size and structure" (Furtan and Thompson 1980:26). The use of larger and improved mechanical and herbicidal inputs has provided substantial advantages to large farming operations rather than to small ones.

The implications on the price of land of improved technological inputs favouring larger farming units could be substantial. Furtan and Thompson project the average acreage per Alberta farm to expand to 950 acres by 1990. Increasing concentration of ownership; that is, more large landholders, combined with greater numbers of small census farms could continue the upward movement of land prices.

Farm Labour Costs

Although input prices have risen rapidly during the last 20 years, farm wages have risen even faster (see Table 1). As a result, the relative price of technological inputs has been less than that of farm labour. Producers were able to cut costs by purchasing larger equipment to substitute for farm labour. It is important to note that this 20-year trend away from increased farm labour toward higher levels of machinery and chemical inputs, to the extent that it is economically based, shows signs of continuing. Input prices have escalated rapidly since the oil embargo of 1973 and the skyrocketing petroleum prices which followed, but farm wages have increased relatively more quickly. Using 1973 as a base, farm input prices have increased 198 percent while farm labour costs have increased 235 percent during the period to 1979 — this despite the fact that average farm wages up to 1979 were still only half those of industry (Anderson and Associates 1981). Because of the increasing complexity of agricultural machinery and the need for experienced and skilled farm labour, wages paid for agricultural labour must now compete with wages for alternative employment such as industrial heavy equipment operation. In order to compete for skilled farm workers, agricultural wages will have to increase relative to industrial wages. Starting from a base point of only 51 percent of industrial wages in 1979 will require a tremendous increase in farm labour wages before rates begin to compete with industrial wages. The trend away from labour inputs to agriculture may continue or intensify, given the need to compete with

industrial wages and the rapid farm labour wage increases that implies. Machinery inputs may still involve more cost-savings than hired labour inputs.

Rapidly increasing farm labour costs could have an indirect effect on land prices. Technological inputs (other than higher yielding crop varieties) may not continue to improve operator efficiency indefinitely (for example, tractor and other implement size may be limited by terrain and other physical factors, and huge increases in fertilizer applications may be counterproductive). If this is the case, farm size may be limited by farm labour costs and availability. When a family farmer reaches the upper limit of acreage he and his family can adequately cultivate, producer demand for land may level off or decrease. If demand for land is reduced, the rate of increase in land prices may also be reduced. Ultimately, the precise mix of technological and labour input costs in conjunction with the price of agricultural land will determine producer decisions to expand their operations.

Increased Farm Product Prices

Increased prices for agricultural products may have influenced the upward movement of agricultural land prices. During the 1961-1979 period, farm prices for agricultural products rose 189 percent (see Table 1). During the same period, input prices rose even more rapidly, which would ordinarily mean that producers would turn to land purchase as the most economical means for increasing production. However, land prices have outstripped both input and product prices since 1961. According to the data presented in Table 1, and other things being equal, it has not been economically sound to acquire more land rather than increase inputs to present land holdings during the 1961-1979 period. Of course, holding all other factors equal ignores the difference in expected returns per dollar of additional input versus a dollar's worth of additional land. Yield per acre for the seven major crops grown in Alberta did not increase at the same rate as the cost of inputs during the 1961-1980 period (see Table 20, Chapter 4). These factors taken together could indicate that the purchase of land, despite its rise in price, is economically more efficient in raising producer income than increased inputs.

Quotas, Grazing Land, Marketing Boards, and the Crow Rate

Under certain conditions, the quota policies of the Canadian Wheat Board provide an incentive to purchase more land. Since quotas are based on seeded acreage and summer-fallowed acreage rather than productivity, farmers with large amounts of extensively farmed land along with substantial amounts of summerfallow have a great advantage during periods of restrictive quotas. Quotas on seeded acreage make no distinction among varying levels of productivity. An irrigation farmer with good soil and weather conditions may produce 55 bushels of wheat per acre compared to 20 for dryland farmers. If both farmed 1000 acres and quotas were set at 18 bushels per acre by the Canadian Wheat Board, the irrigation farmer could deliver less than one-third of his harvest while the drylander could deliver 90 percent of his. The irrigation farmer would then have to pay storage costs for 37,000 bushels during the tight quota period while the drylander would have to store only 2000 bushels. This is an extreme example, but the incentive to acquire more land and farm it more extensively rather than intensively may have motivated some producers to enlarge their acreage to reduce carrying costs during periods of tight quotas.

Early in 1982, the Canadian Wheat Board announced a change to the quota structure for the 1982-83 crop year. A productivity factor has been incorporated into the quota formula whereby each farmer's summerfallow and special crops acreage is subtracted from one-third of his acreage planted to any of the six major grains (barley, flax, oats, rapeseed, rye, and wheat). The difference is added to the farmer's quota base acreage. For example, if a producer has a quota base of 1000 acres, 900 of which are planted to wheat and barley and 100 summerfallowed, his final quota is determined by subtracting his summerfallow acreage (100 acres) from one-third of his grain crop acreage (300 acres). The result (200 acres) is added to the quota base for a total of 1200 eligible acres. The objective of this formula is to equalize quota delivery opportunities for those producers with intensive cropping operations.

Grazing leases on public land can acquire a substantial capital value for the lessee. Grazing rights can be assigned or transferred by the lessee to other producers, thereby accumulating value, even though this value is essentially a gift from the provincial government. Grazing leases do not require a large capital investment, but at present are limited in supply in some areas of the province. To the extent that grazing leases compete with privately owned land for livestock production, the value of privately owned grazing land will increase, especially for land which adjoins a grazing lease. However, the availability of Crown grazing land could depress the cost of private grazing land if the demand for grazing land can easily be met by Crown land available in the area. The influence of this factor on the overall price of agricultural land in Alberta is probably miniscule, but there may be some impact in certain localities, especially for lower capability (class 5 and 6) land.

Marketing board quotas may have a fairly large influence on certain rather small land holdings in Alberta. Quotas established by supply management marketing boards for milk, eggs, broiler chickens, and turkeys invariably acquire value in themselves. For example, it has been estimated that the value of the egg quota alone, on an average Alberta egg-producing farm, was \$47,000 in 1978 (Veeman and Veeman 1980). This value is often capitalized into the land, buildings, and equipment of the farm. At the present time, the influence of marketing board quota values on the price of agricultural land is limited to the four commodities listed above, and these values probably do not play a significant role in average agricultural land price determination. However, if beef and/or hog marketing boards with supply control functions were established, the impact of quota value capitalization into land prices could increase average land values in the province.

D.R. Harvey assumed that the statutory Crow rate for grain transportation (see Chapter 6) amounted to a subsidy for western grain producers, and estimated that capitalization of this value into agricultural land may have increased the price of agricultural land by \$40 per acre (Harvey 1980:79). His estimate was based on the assumption that western grain producers purchased additional land with the expectation that Crow rate "benefits" would be continued, thus increasing the value of the land by as much as the perceived Crow benefit. This benefit was estimated at \$220 million per year which, when distributed over approximately 50 million acres and 20 years discounted at 10 percent, amounted to \$40 per acre.

An earlier study commissioned by the Alberta Cattle Commission also concluded that the Crow rate has a very important impact on Alberta land prices (MacEachern 1978). This study indicated that the Crow rate may have raised the price of agricultural land capable of

producing 40 bushels of barley per acre by up to \$140 per acre. MacEachern concluded that this land may continue to increase in value by \$10 to \$12 per acre per year due entirely to the retention of the Crow rate (MacEachern 1978:42). Both of the above studies report that the full amount of benefit of the Crow rates to western producers may not be capitalized into land prices, but presented their estimates as maximum values.

PROBLEMS ASSOCIATED WITH HIGH AND INCREASING LAND PRICES

The number of farms in Alberta declined by nearly 20 percent between 1960 and 1979 while the area of improved acreage increased by almost 20 percent (Anderson and Associates 1981). This pattern combined with the previously described trend towards very large farms could ultimately result in relatively few landowners controlling agricultural land in the province (see Table 2). Farms operated by full owners of the land decreased from 80 percent of all farms in Alberta in 1921 to 60 percent in 1976, while farms with partial ownership by the operator combined with some rental property increased from 10 percent to one-third of the total. Assuming a single owner per farm (corporate farms with more than one owner may be offset by a single individual owning more than one farming operation), and that all farmers are over 25 years of age, in 1976 all agricultural land qualifying for census farm status which was privately owned was owned by 6.4 percent of the total Alberta population

Table 2. Distribution of acres per census farm size in Alberta, 1961 and 1976

Acres/Farm	Number of Farms		Percent Change		Percent Change
	1961	1976			
< 3	238	87	-63.4	}	-33.9
3 - 9	683	281	-58.9		
10 - 69	1813	1837	- 1.0		
70 - 239	15408	10253	-33.5		
240 - 399	19385	10605	-45.3		
400 - 559	11763	7871	-33.1	}	+23.6
560 - 759	8421	7227	-14.2		
760 - 1119	7498	8155	+ 8.8		
1120 - 1599	3969	5033	+26.8		
1600 - 2239	1842	2630	+42.8		
2240 - 2879	766	1201	+56.8	}	
2880 +	1426	2140	+50.1		
Total Farms	73212	57310	-21.7		

Source: Adapted from Furtan and Thompson 1980: 16.

over 25 years old (Alberta Agriculture 1981a, Alberta Treasury 1980). Wilson (1981:85) described the evolution of a small group of landowners as follows:

What was once considered a right by many on the prairies — ownership of land and the chance to become a farmer — has now become a privilege, available often because of whom you know or are related to, rather than how hard you are willing to work. A privileged landowning class is evolving, and entry to that class is increasingly restricted to the sons, daughters, and relatives of landowners who can offer land through inheritance or family help.

A small landowning group may not constitute any threat to the security of the agricultural land base. Most agricultural commodity production in Alberta is still relatively open to new entrants, provided they have the skills and more importantly, the capital. But increasing land prices combined with technological advances favouring the larger farm operations and other factors discussed in the previous section have created an immense barrier for anyone who lacks capital and is contemplating entering agriculture as landowner. Using an average farm size of 817 acres (Furtan and Thompson 1980) and an average 1980 price per acre for class 1 to 4 land of \$398.58 (Miller 1981), the initial cost of entry would be \$325,000. A more recent study by the Farm Credit Corporation Canada calculated that the average farm in Alberta contained a net equity value (total assets less total liabilities) of \$684,097 in January of 1981. This calculation was based on a survey of Alberta farms (Farm Credit Corporation Canada 1981). This is only the price of admission; to actually farm the property cost an average of about \$40,000 during 1980 (Alberta Agriculture 1981a). In addition, 817 acres of average land may not be enough for long-term economic viability. There is another method of entry for those wishing to become farmers in Alberta. The going rate for land rental is substantially less than the mortgage cost of an equivalent amount of purchased land.

A second potential problem with high and rising prices for agricultural land may be a tendency to farm without fully replenishing soil nutrients. As the ratio of the price of land to other inputs (for example, chemicals and machinery) increases, it becomes economically beneficial to produce more per acre with a reduced expenditure for inputs. Ultimately this market mechanism could force prairie farmers into depleting soil nutrients in order to keep pace with rising land costs. To the extent that rising land prices are fueled by factors external to agriculture, no market mechanism exists to shield farmers from the necessity to produce ever more per acre. That is, agricultural land prices may not level off due to an inability to pay for the land with profits from commodity production to the extent that the price of agricultural land is determined by non-agricultural forces (for example, urbanization, non-farm speculation, etc). The recent increase in the price of agricultural land has not solely been based on a rise in productive value (Miller 1981), and is to that extent based on non-agricultural forces. Thus the market may be transmitting false information on the way the land input should be used as a factor of production.

Net removal of soil nutrients (especially nitrogen) may be the only option open to many farmers faced with land prices escalating beyond their ability to pay for it, based on current production and prices. What's more, other factors such as technological inputs provide an incentive to acquire a large land base for efficient production. Thus, producers could conceivably be faced with a situation wherein they are forced to produce more in the short run without adequately replacing soil nutrients in order to keep pace with the value of the land

while at the same time requiring more of the overpriced land in order to continue to operate efficiently. This paradoxical situation could continue the upward movement of land prices even with no improvement in agricultural product prices.

A third detrimental effect of escalating prices for agricultural land involves the relationship between land prices and food prices. It seems logical that higher agricultural land prices should lead to higher food costs. But higher food costs are not necessarily an immediate consequence of higher land values for a variety of reasons. First, we import a very high percentage of the food we eat. Most Alberta-grown agricultural produce is exported to the rest of Canada or out of the country and therefore must compete in the world market. Second, rising land prices may induce more intensive and efficient use of land which could actually lower product prices due to higher volumes and more efficient production. Third, rising land prices do not appear to be following rising product prices. Therefore, why should one expect product prices to follow land prices? However, both situations appear anomalous to economists (Roberts and Brown 1980). In the longer term, higher food prices may be an inevitable adjunct to higher land values.

Much of the rise in land prices stems from competition for land for purposes other than agriculture. Non-agricultural use of good agricultural land makes productive land increasingly scarce, thereby raising the value of not only the land but the agricultural produce. Intensive use of the soil to increase production to pay for the land is costly over both the short and long run, further raising the required price of agricultural commodities (assuming negligible productivity gains). Agricultural production for export markets could become unprofitable unless world demand increases substantially in terms of price, not merely volume. Higher prices for land and other inputs in the long run require either higher volumes produced per acre or higher product prices.

Prices for domestically consumed agricultural produce will likely increase to keep pace with higher land values, but prices for export grain may not keep pace. The international market for grain takes no account of high land values or increasing input prices in Alberta. Decreasing or steady international demand is unlikely under present world conditions, at least with respect to volume. There is some question concerning the ability of importing countries to pay ever higher prices. At constant prices, increased export volume will only assist producers in paying for their high-priced land if farmers are able to produce more *per acre* at constant or declining real costs per unit of output. This completes the cycle back to mining the land as a likely response to increasing land prices and stable world commodity prices, regardless of export volume.

A fourth problem arising from escalating land prices is a strong disincentive for younger people to take the risk and become farmers. Most often there is no possibility for young persons to accumulate the capital required to buy a farm, and there are serious risks involved even if the capital can be raised and a loan for land can be found. The production of most agricultural commodities differs from most other industrial sectors in that there is no direct link between input prices, product prices, and net returns. Agricultural production may experience rapid increases in input prices with no increase in product prices and still receive increasing net returns if production increases sufficiently. By the same token, farmers could be blessed with falling input prices and skyrocketing product prices yet suffer severe financial difficulties. The agricultural sector of the economy is subject to such wide variation in

productivity from year to year that unit cost and unit price alone do not explain the well-being of farmers (Lyons 1980).

The result of these annual vagaries in production from farm to farm is a high risk for new farmers. Beginning farmers faced with huge debt loads from purchasing high-value land may not be able to survive more than one poor production year, or one year in which input prices rise without a corresponding product price increase. This higher risk of loss is not compensated for by a good chance of reaping huge profits from agricultural production. Instead, a margin of protection is provided by the ability to resell the property on a steadily rising land market. Farmers therefore have a vested interest in high or rising land prices in spite of the pressure they are under due to high land prices.

Data from 1961 to 1976 indicate that the average age of farmers in Alberta remained relatively constant during that period (Alberta Agriculture 1981a). However, because land values have increased by more than 300 percent between 1976 and 1979 (see Table 1), the 1981 census may show that the average age of farmers is actually increasing if indeed younger persons are having difficulty entering farming. One factor which may serve to reduce the average age of farmers in Alberta is the relatively young age of farmers in the Peace district (Hanus 1979). Another possibility is that acreage owners still able to qualify under the one acre and \$1200 definition of a census farm may also tend to be younger than the average age of present farmers (47 years).

High interest rates further discourage agricultural land sales. The combined influence of high land values and record high interest rates reduced agricultural land sales by 8.5 percent between 1979 and 1980 (Miller 1981). The percentage of Alberta farms operated by the owner has declined slightly (63 to 58 percent) since 1956 (Alberta Treasury 1980). During the same period (1956 to 1976), the percentage of farm operators who were strictly tenants on the land decreased from 10.7 percent to 6.3 percent and the percentage of owner-tenant operators increased by about 6 percent to 33.3 percent in 1976. Once again, the figures may not represent normal farming operations since acreage residents nearly always own all their land.

If there is to be an increasing portion of land tenancy due to high land prices, certain problems are associated with that trend. One of the most important is the vulnerability of renters to the terms and duration of the landlord's agreement. Short-term contracts leave a tenant insecure in his position and unlikely to invest a great deal of his own initiative and innovation in improving the farm operation (Kraft 1978 and Wilson 1981). Inadequate nutrient replacement may be an economic necessity for a tenant with a one to three year contract based on rental fees in bushels per acre to the landlord (53 percent of the total lease arrangements; Alberta Agriculture 1982b). Tenant farming or absentee landownership with hired management and labour may not be a suitable industrial model for agriculture in Alberta given the necessity for independence and personal motivation associated with farming.

A physical environment richly endowed with suitable soil and climate was the prerequisite for agricultural development on the prairies, but pride of ownership and individual initiative on hundreds of thousands of farms actually brought the potential to fruition. An evolutionary change toward increasing absentee ownership and short-term tenancy for people actually tilling the soil could have a serious negative effect on the care with which the soil is treated.

SUMMARY

Taking care of our diminishing agricultural resource base is in the best long-term interest of all people, but short-term economic conditions could cause irreversible harm to that most fundamental of prerequisites for large-scale food production, productive soil. The marketplace may not be able to resolve stresses in the agricultural sector of our economy caused by rapidly increasing land prices. Market forces external to agriculture may distort land prices, creating pressures on farmers to produce ever more per acre regardless of the long-term effects on soil fertility. To be equitable, future generations of Albertans should have some influence on present agricultural practices. This is not possible in the context of present market structures, and some would argue that consideration of the well-being of future generations is foolish since technological solutions to current perceived problems will change future circumstances anyway. The contrary opinion was expressed by Georgescu-Roegen: "The market price could be relied upon to solve the ecological problem — of the allocation of mankind's dowry and of pollution production — only if all future generations also participated in the bidding" (quoted from Jackson 1980:102). Regardless of which opinion proves to be true, present problems in the agricultural sector, of which rising land prices are but one, could force future generations into relying on further technological "fixes" which may or may not work.

AGRICULTURAL DEVELOPMENT IN THE PEACE RIVER REGION

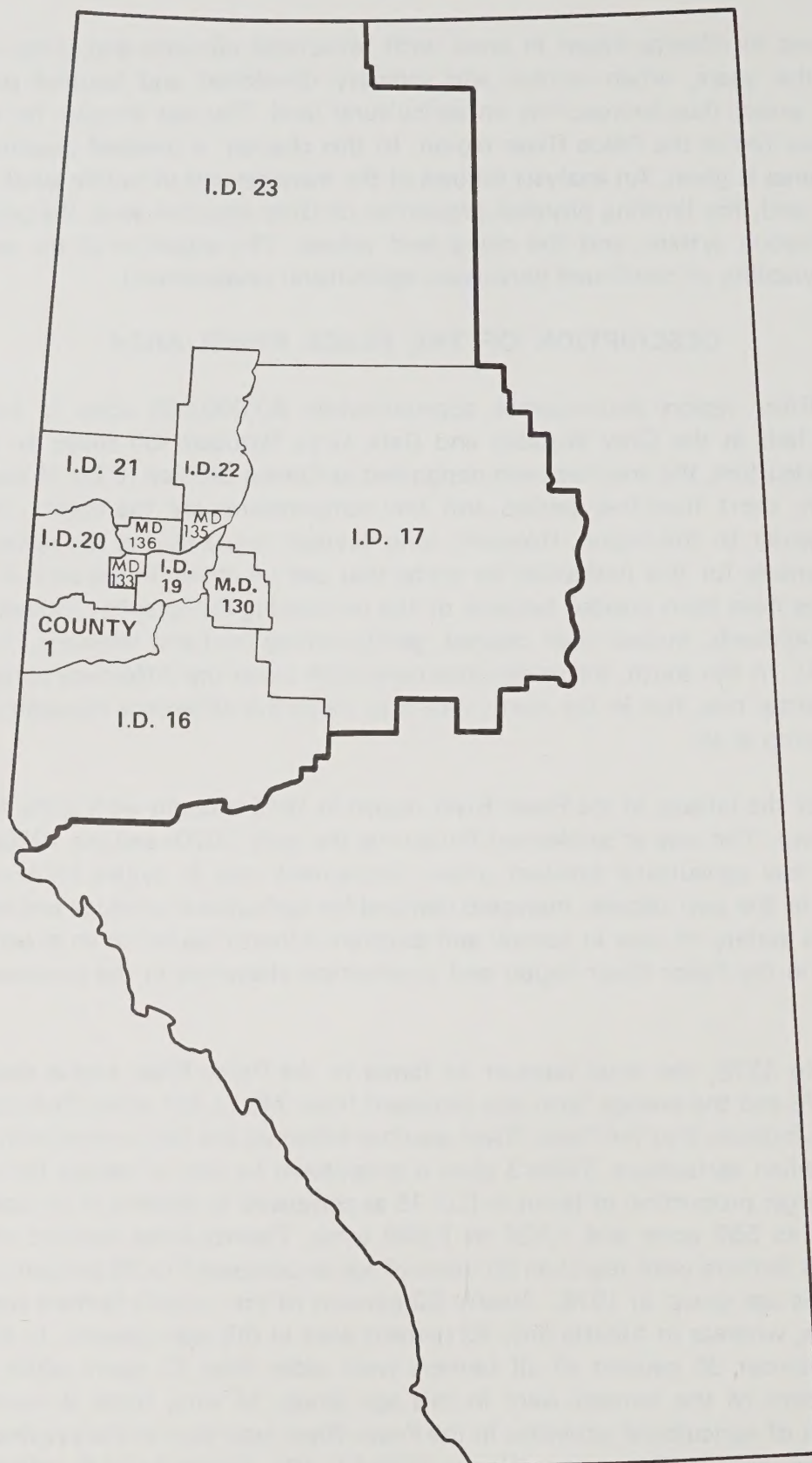
Past settlement in Alberta began in areas with favourable climates and prime agricultural land. Over the years, urban centres and industry developed and became concentrated within these areas, thus encroaching on agricultural land. The last frontier for agricultural expansion now lies in the Peace River region. In this chapter, a detailed description of the Peace River area is given. An analysis follows of the management of public lands, the potentially arable land, the limiting physical properties of Grey Wooded soils, the grain handling and transportation system, and the rising land values. The objective of the analysis is to evaluate the viability of continued northward agricultural development.

DESCRIPTION OF THE PEACE RIVER AREA

The Peace River region encompasses approximately 60,000,000 acres in northwestern Alberta and falls in the Grey Wooded and Dark Grey Wooded soil zones. In the Canada Census of Agriculture, the area has been designated as Census Division (C.D.) 15 (see Figure 1). The relatively short frost-free period and low temperatures are the major climatic constraints particular to the region. However, long daylight hours during the summer months partly compensate for this limitation for crops that can be grown in the area. A number of micro-climates have been created because of the undulating topography. Indeed, the region consists of highlands, incised river courses, gently rolling land and flatlands (Johnson and Lowe 1980:4). In the south, micro-climates may often mean the difference between a good crop and a better one, but in the north they may mean the difference between a successful crop and no crop at all.

The advent of the railway in the Peace River region in 1915 brought with it the first agricultural settlement. The rate of settlement fell during the early 1920s and the 1930s as a result of relatively low agricultural product prices. Settlement rose in cycles following the two World Wars. In the past decade, increased demand for agricultural produce and competition for land for a variety of uses in central and southern Alberta has led to an expansion in the area farmed in the Peace River region and a reduction elsewhere in the province (Deloitte 1980).

From 1966 to 1976, the total number of farms in the Peace River region declined from 8,868 to 8,128 and the average farm size increased from 343 to 481 acres (Deloitte 1980:4). These figures indicate that the Peace River area has followed the farm consolidation trend in western Canadian agriculture. Table 3 gives a breakdown by size of census farms. In 1976 there was a larger proportion of farms in C.D. 15 as compared to Alberta in all size categories between 400 to 559 acres and 1,120 to 1,599 acres. Twenty-three percent of the Peace River region's farmers were less than 35 years of age as compared to 20 percent of Alberta's farmers in this age group in 1976. Nearly 50 percent of the region's farmers were younger than 45 years, whereas in Alberta only 43 percent were in this age category. In the province as a whole, almost 30 percent of all farmers were older than 55 years while in C.D. 15 only 23 percent of the farmers were in this age group. In sum, there is more potential for expansion of agricultural activities in the Peace River area than in the province since the farmers are younger in this region (Hanus 1979:17, 19). Tables 4 and 5 indicate that for operators classified by tenure and area classified by tenure of operator, there is a higher proportion of owned farms and a lower proportion of leased farms in C.D. 15 as compared to Alberta.



Source: Deloitte 1980:Figure A

Figure 1. Peace River Region of Alberta (C.D. 15)

Table 3. Census farms classified by size, 1976

Acres	Alberta		Census Division 15	
	No.	%	No.	%
3	87	.2	7	.1
3 - 9	281	.5	12	.1
10 - 69	1827	3.2	60	.7
70 - 239	10253	17.9	1007	12.4
240 - 399	10605	18.5	1460	18.0
400 - 559	7871	13.7	1195	14.7
560 - 759	7227	12.6	1365	16.8
760 - 1119	8155	14.2	1608	19.8
1120 - 1599	5033	8.8	855	10.5
1600 - 2239	2630	4.6	309	3.8
2240 - 2879	1201	2.1	115	1.4
2880 +	2140	3.7	135	1.7
Total	57310	100.0	8128	100.0

Source: Statistics Canada 1978: Adapted from Table 12.

FIELD CROP PRODUCTION

In the Peace River region during 1980, the seeded acreage of wheat, oats for grain, barley for grain, fall rye, spring rye, rapeseed, and flaxseed totalled 2,383,500 acres with an overall production of 77,903,400 bushels. Nearly half (46.5 percent) of the total production of grain and oilseeds consisted of barley, with wheat making up 25.9 percent and rapeseed 18.3 percent of the total. The most notable crops in terms of acreage seeded were, in order of importance, barley, rapeseed, and wheat. (For a more detailed breakdown of statistics, see Appendix B, Table B1.) In general, the Peace River region is well suited to earlier maturing crops, especially barley, rapeseed, oats, and forage crop seed. Wheat and flax, which are later maturing crops, must be seeded early although they may be grown successfully in most years, particularly in the southern sub-regions (Deloitte 1980:27).

Over the years, crop yields have progressively improved in C.D. 15. There was a 43 percent increase from the 1956-1960 average to the 1971-1975 average wheat yield, a 42 percent increase in oats yield, a 39 percent increase in barley yield, a 29 percent increase in rapeseed yield and a 36 percent increase in flax yield. The higher yield per acre has arisen from the adoption of higher yielding seed varieties, more timely cultural practices and the use of fertilizers and pesticides (Deloitte 1980:29). There has been a marked decline in the difference between average yields of the Peace River region and those of the province as a whole.

Table 4. Operators classified by tenure, 1976

	Number	Alberta %	Census Division 15 Number	%
Owner	33,584	58.6	5,323	65.5
Tenant	3,520	6.1	366	4.5
Part Owner, Part Tenant	20,206	35.3	2,439	30.0
Total	57,310	100.0	8,128	100.0

Source: Statistics Canada 1978: Adapted from Table 13.

Table 5. Area classified by tenure of operator, 1976

	Acres	Alberta %	Census Division 15 Acres	%
Owner	17,200,826	34.7	3,060,522	49.8
Tenant	3,896,468	7.9	259,474	4.2
Part Owner, Part Tenant	28,422,584	57.4	2,831,470	46.0
Total	49,519,878	100.0	6,151,466	100.0

Source: Statistics Canada 1978: Adapted from Table 13.

Between 1956 and 1975, wheat averaged 2.5 bushels per acre less than the provincial average, oats 4.6 less, and barley 5.7 less. But between 1971 and 1975, the difference was only 0.8 bushels per acre for wheat, 1.5 for oats, and 4.8 for barley (Deloitte 1980:29). In the 1976 to 1980 period, wheat averaged 0.9 bushels per acre above the provincial average, oats 1.4 less and barley 7.8 less (see Appendix B, Table B1).

The profitability of various crops is often measured by the gross margin, or returns over cash costs. Gross margin consists of the residual left to pay for the operator's labour, depreciation, investment in land, buildings, machinery, and supplies (Visser 1980). Table 6 gives an approximation of the gross margin for 200 acres each of rapeseed, wheat, and barley and Table 7 provides an adjustment schedule as yield and price expectations change. According to the figures in Table 6, rapeseed provides the highest gross margin per crop and constitutes 38.4 percent of the gross margin per farm. It thus follows that the Peace River region as a whole has the largest area seeded to rapeseed along with the highest production of all Agricultural Reporting Areas in the province. Indeed, C.D. 15 produces 28.5 percent of all

Table 6. Gross margin for rapeseed, wheat, and barley on 200 acres each in the Peace River region

(PER ACRE)	Rapeseed	Wheat	Barley	Total
Yield	16	20	30	
Price	6.00	5.00	2.75	
GROSS RETURN	96.00	100.00	82.50	
CASH COSTS:				
Seed & Seed Treatment	2.89	9.42	8.56	4174.00
Fertilizer	5.50	5.50	5.50	3300.00
Chemicals	5.00	5.00	5.00	3000.00
Machine Op. & Rep.	18.18	18.18	18.18	10908.00
Interest	3.18	3.77	3.69	2127.42
Taxes	1.25	1.25	1.25	750.00
Misc.	2.51	2.51	2.51	1506.00
Summerfallow				
TOTAL CASH COSTS	38.51	45.63	44.69	25765.42
GROSS MARGIN/acre	57.49	54.37	37.81	
Acres Planted	200	200	200	
GROSS MARGIN/crop	11498.06	10874.52	7562.00	
GROSS MARGIN/farm				29934.58

Source: Alberta Agriculture, Regional Economic and Business Services Branch, Fairview.

Table 7. Adjustment schedule in yield and prices for rapeseed, wheat, and barley

RAPESEED GROSS MARGIN (per acre)							
Yield in Bushels							
PRICE (\$)	10	13	16	19	22	25	28
4.50	6.49	19.99	33.49	46.99	60.49	73.99	87.49
5.00	11.49	26.49	41.49	56.49	71.49	86.49	101.49
5.50	16.49	32.99	49.49	65.99	82.49	98.99	115.49
6.00	21.49	39.49	57.49	75.49	93.49	111.49	129.49
6.50	26.49	45.99	65.49	84.99	104.49	123.99	143.49
7.00	31.49	52.49	73.49	94.49	115.49	136.49	157.49
7.50	36.49	58.99	81.49	103.99	126.49	148.99	171.49

WHEAT GROSS MARGIN (per acre)							
Yield in Bushels							
PRICE (\$)	10	15	20	25	30	35	40
3.50	-10.63	6.87	24.37	41.87	59.37	76.87	94.37
4.00	-5.63	14.37	34.37	54.37	74.37	94.37	114.37
4.50	-0.63	21.87	44.37	66.87	89.37	111.87	134.37
5.00	4.37	29.37	54.37	79.37	104.37	129.37	154.37
5.50	9.37	36.87	64.37	91.87	119.37	146.87	174.37
6.00	14.37	44.37	74.37	104.37	134.37	164.37	194.37
6.50	19.37	51.87	84.37	116.87	149.37	181.87	214.37

BARLEY GROSS MARGIN (per acre)							
Yield in Bushels							
PRICE (\$)	20	25	30	35	40	45	50
1.60	-12.69	-4.69	3.31	11.31	19.31	27.31	35.31
2.00	-4.69	5.31	15.31	25.31	35.31	45.31	55.31
2.35	2.31	14.06	25.81	37.56	49.31	61.06	72.81
2.75	10.31	24.06	37.81	51.56	65.31	79.06	92.81
3.15	18.31	34.06	49.81	65.56	81.31	97.06	112.81
3.55	26.31	44.06	61.81	79.56	97.31	115.06	132.81
4.00	35.31	55.31	75.31	95.31	115.31	135.31	155.31

rapeseed grown in Alberta (see Appendix B, Table B1). The success of rapeseed may be attributed to the fact that it produces well on Grey Wooded soils because of moisture availability (University of Alberta 1971:47). Moreover, the price of rapeseed (\$6.24 per bushel in the 1979-80 crop year) is relatively higher than the price of other crops.

The Northern Alberta Rapeseed Processors (NARP) plant located at Sexsmith in the County of Grande Prairie provides an important outlet for rapeseed. In its capacity as a manufacturing activity, the rapeseed crushing and processing plant diversifies the economic base of the area. NARP extracts oil from rapeseed and converts the by-product into meal (Hollinshead 1979:110). Because of high transportation costs and a limited local market, additional refining of rapeseed oil into margarine and other products is unlikely. The inclusion of rapeseed in the crop rotation raises annual net values, although prolonged dependency on this crop increases its vulnerability to plant disease or insect damage and reduces soil productivity. For these reasons, rapeseed should not be included in the rotation more than once every three or four years. However, along with nitrogen-building forage crops, crops such as barley require stable markets if they are to be integrated more into crop rotations (Deloitte 1980:8).

LIVESTOCK PRODUCTION

Between 1978 and 1981, the total number of cattle and calves in the Peace River region declined in each successive year but represented more than 4 percent of Alberta's total number. The total number of pigs in this period fluctuated but represented over 4 percent of the total number of pigs in the province from 1977 to 1979 and more than 3 percent from 1980 to 1981 (see Appendix B, Tables B3 and B4). The number of livestock farms in C.D. 15 was less than half the expected proportion of the total number of farms found in Alberta in 1976 (Statistics Canada 1978:Table 15). Expansion of livestock enterprises has been deterred by the severe climate of the region which lengthens the period of winter feeding and by the unavailability of groundwater for wells. In fact, most farmers are unable to feed livestock during the winter months because of off-farm employment. The additional revenue obtained from employment during the off-season is often more attractive to farmers than engaging in livestock production (Deloitte 1980:10). In the short run, the livestock market is highly cyclical, resulting in "boom and bust" prices. Long run growth in the market will depend upon the rate of increase in population, the relative prices of substitutes, and development of export markets (Hollinshead 1979:109, Horner 1981). Additional grazing reserves, which are currently being developed, along with higher prices could increase livestock numbers in the region. However, there is a lack of infrastructure to promote livestock production since slaughtering plants, feedlots, and cattle liners are not readily available. Moreover, transportation costs to the distant markets are high (Deloitte 1980:9).

FORAGE PRODUCTION

There is a lack of production and price data for hay and other forage products relative to other agricultural products since on most farms forage is an input to livestock. According to Alberta Agriculture, in the Peace River region in 1980, 643,100 acres were seeded to tame hay and the total production was 923,500 tons (see Appendix B, Table B1). Both forage and legumes may be viewed as producing two products since some varieties improve soil

productiveness by adding fibre and opening up the subsoil to water percolation (Johnson and Lowe 1980:64). But income statements do not allocate positive returns to forage production for its soil-improving capability. Such returns, although difficult to quantify, would increase the benefits associated with growing forage. Based on current calculations of average returns, the farmer's decision regarding crop rotations may be sub-optimal with respect to the prevention of soil depletion since forages do not compete well with cereal and oilseed production (Johnson and Lowe 1980:72). Market prices for forage crop seeds are unstable and little hay is needed locally because of the low level of livestock production. Forage and grass seed production is a significant industry in some parts of the Peace region. The instability of the livestock market itself prevents the adoption of desirable soil management practices that include forages as prominent crops in the rotation.

VALUE OF PRODUCTION

The value of agricultural products sold on census farms in 1976 for Alberta and the Peace River region is listed in Table 8.

Larger proportions of farms in C.D. 15 as compared to Alberta were in the three lowest categories of farm sales by value and, conversely, lower proportions were in the three highest categories. Farms in C.D. 15 were close to Alberta proportions for sales categories between \$10,000 and \$50,000.

Table 8. Farm sales by value, 1976

Dollars	Alberta		Peace River (C.D. 15)	
	Number	%	Number	%
\$100,000 +	2,692	4.7	87	1.1
75,000 - 99,999	1,743	3.0	88	1.1
50,000 - 74,999	3,989	7.0	275	3.4
35,000 - 49,999	4,598	8.0	500	6.1
25,000 - 34,999	5,633	9.8	708	8.7
15,000 - 24,999	8,631	15.1	1,241	15.3
10,000 - 14,999	7,220	12.6	1,181	14.5
5,000 - 9,999	9,892	17.3	1,759	21.6
2,500 - 4,999	7,499	13.1	1,315	16.2
1,200 - 2,499	5,242	9.1	951	11.7
Institutional farms	171	.3	23	.3
Total	57,310	100.0	8,128	100.0

Source: Statistics Canada 1978: Adapted from Table 14.

COST OF INPUTS

Average farm input prices in 1980 were higher in the Peace River region than in Alberta as a whole for 25 of the 40 major inputs (see Appendix A, Table A5). However, some heavy farm machinery was relatively cheaper in the region. But the returns per unit of the production inputs are lower in the Peace River region relative to other agricultural regions in Alberta because of the marginal quality of much of the land (Bentley 1978:16). Moreover, extremely large investments in machinery are a necessity in C.D. 15 because of the short growing season. Both seeding and harvesting must be done quickly in the short time when climatic conditions are favourable. But frequently the conditions are not suitable for spring and fall field work because field tractability is diminished on wet or snow-covered soils. Estimates of the probability of field work on any day in April on medium- to fine-textured soils at Beaverlodge and Fairview are 0.16 and 0.14 respectively. The corresponding probabilities for tractability at Edmonton and Calgary are 0.35 and 0.36 respectively, or more than twice as high. For the month of October the difference is even larger. The divergence in probabilities is lower between May and September, although these months do not have as great a bearing on field work (Lindsay et al. 1981:353). Grain drying is more crucial in the Peace River region than in other grain-producing areas in Alberta since farmers are often forced to harvest tough or damp grain before the onset of cool weather and snow. Drying is uneconomical on farms less than 400 acres in size, or approximately one-third of the farms in the region. However, there is joint ownership of a dryer on some of the farms that fall in this category (Deloitte 1980:80). A dryer costs between \$8,000 and \$20,000 while the energy costs for drying are roughly 5 cents per bushel. The latter may vary depending on the moisture content of the grain, ambient temperature at the time of operation, and the cost of fuel (Deloitte 1980:80). Despite the large capital outlay necessary for viable field operations, the Peace River region still has a greater emphasis on field crop production than the other agricultural regions in Alberta.

APICULTURE

The Peace River region is a major centre for apiculture (honey production) in Alberta. Although returns are susceptible to world price fluctuations, there has been a general increase in both the rate of growth of the industry and the price of honey over the years (see Table 9). Apicultural operations have been expanding in the Peace River region relative to other honey-producing areas in Alberta. The yield per colony is higher in the Peace River region because of economies of scale incurred by the greater number of colonies per beekeeper (see Table 10). However, the yield per hive is highly variable and is affected by weather conditions, length of blooming period, and amount of pasture during the honey flow season, along with the degree of wind protection and the general performance of the bees (Andruchow 1981:4-5). During the spring season, both willow and dandelion are major sources of pollen and nectar while rapeseed, clover, alfalfa, and fireweed are important during the summer and fall (Andruchow 1981:4-5). The substitution of rapeseed for clover has been beneficial to apicultural operations since rapeseed flowers earlier in the season (Hollinshead 1979:112).

Cost and return data is scarce in the apiculture industry. The most recent study conducted by Alberta Agriculture in 1979 consists of a survey of 74 apiarists throughout the province. The 74 participants were divided into three groups in one section of the study in order to

Table 9. Statistical data on honey production in Alberta, 1924 - 1979

Year	Number of Beekeepers	Number of Colonies	Production Per Colony (lbs.)	Price Per Pound (cents)
1924	160	-	-	25
1930	170	4450	222	10
1935	1000	13060	84	9
1940	2200	22000	101	11
1945	10000	63000	95	15
1950	4150	49000	99	13
1955	1270	35200	131	16
1960	1670	54900	138	15
1965	1320	114000	176	15
1970	1200	110000	184	14
1971	1200	115000	196	19
1972	1200	130000	154	30
1973	1300	145000	150	45
1974	1800	156000	114	41
1975	2000	158000	88	40
1976	2000	160000	128	37
1977	1800	165000	130	43
1978	1800	160000	125	51
1979	1700	150000	150	57

Source: Andruchow 1981: Table 1.

estimate the costs and returns for honey production by region. The groups consisted of Northern Alberta (the Peace River and Barrhead regions), Central Alberta (the Vermilion and Red Deer regions), and Southern Alberta (the Calgary and Lethbridge regions). Table 11 provides a summary of costs and returns by region. The figures indicate that operating costs for central Alberta apiarists are approximately 43 percent higher than those for the northern and southern areas. Because of the relatively larger size or higher density of operations in northern Alberta, cost components such as vehicle expenses, interest on operating capital, depreciation, and family labour are lower as compared to the southern and central groups. The higher yield per hive in northern Alberta adds to the differential. Table 12 displays the effect of higher yields on price per pound of honey sold required to cover total production costs.

Larger apiaries, such as those located in the Peace River region, are evidently more profitable than smaller operations since both the level of production and yield per colony are relatively higher (Andruchow 1981:15).

Table 10. Honey production in Alberta by region, average of 1977 to 1980

Region	Number of Beekeepers	Number of Colonies	Number of Colonies per Beekeeper	Yield per Colony (lbs.)	Production	% of Total Production
Southern	138	17,500	127	137	2,397,500	10.9
Central	588	17,000	29	117	1,989,000	9.0
Northern	856	66,500	78	124	8,246,000	37.3
Peace River	206	58,750	285	161	9,458,750	42.8
Province	1,788	159,750		138	22,091,250	100.0

Source: Andruchow 1981: Adapted from Table 2.

PART-TIME FARMERS

The highest percentage of part-time farmers falls within the 35-55 age category and most younger men enter farming on a part-time basis (IEC 1980:13). Over the past 20 years, a large proportion of part-time farmers have run farms between 70 and 399 acres in the Peace River region, although in the past decade the number occupying larger farms has risen. This parallels the trend of full-time farmers, who operate larger but fewer farms (IEC 1980:16). Factors preventing part-time farmers from becoming full-time farmers include the escalating land values in the Peace River region, the difficulty for farmers to qualify for public land grazing leases because of their part-time status, and the stipulation in Agricultural Development Corporation loans whereby farmers must prove their ability to farm full-time in a reasonable period of time (IEC 1980:17). The principal reasons the part-time farmer decides to seek off-farm employment are to raise the required capital for development and expansion of the farm unit and to supplement farm income in order to maintain an average standard of living. Since most part-time farmers run grain operations, they seek off-farm employment during the off-season in such areas as general construction, logging, trapping, trucking, government services, custom land clearing, and the oil and gas industry (Nichols 1981:59). Seasonal unemployment in the Peace River region depends to a substantial degree on the level of activity in the oil and gas industry. Perhaps reliance on seasonal and part-time employment reduces the incentive for farmers to establish viable holdings. But in most cases, the additional income is essential for part-time farmers to remain in business. Indeed, farmers with the lowest gross farm income tend to have the highest off-farm income (see Table 13).

Table 11. Summary of costs and returns by region

	Northern Alberta	Central Alberta	Southern Alberta
NUMBER OF HIVES	652	219	500
YIELD (pounds per hive)	192.75	131.50	188.50
RECEIPTS	cents/lb.		
Honey Sales	56.14	60.50	54.57
Wax Sales	2.13	2.55	2.88
Pollen Sales	0.03	0	0
TOTAL RECEIPTS	58.30	63.04	57.45
OPERATING COSTS			
Bees and Freight	7.47	11.16	6.57
Vehicle Expenses	2.35	5.30	3.07
Feeding Costs	1.88	1.78	4.40
Veterinary & Medicine	.46	.75	.21
Building Costs	1.89	3.19	1.00
Containers	.62	1.31	.25
Hired Labor	5.83	1.46	3.27
Interest on Operating Capital	.82	1.03	.86
Overhead	3.31	3.13	2.09
Wintering	1.39	3.34	5.02
Depreciation	5.39	13.02	5.71
TOTAL OPERATING COSTS	31.49	45.75	32.92
Operator Labor	3.76	11.17	3.21
Family Labor	.75	1.19	.94
Interest on Investment	9.07	21.93	6.51
TOTAL COSTS	45.07	80.05	43.58
Return over Cash Costs	32.20	30.32	30.23
Return to Unpaid Labor and Management	17.75	-4.64	18.01
Return to Management	13.23	-17.01	13.87
Return to Investment	22.30	4.93	20.38

Source: Andruchow 1981: Table 13.

Table 12. Effect of yield on price per pound required to cover total costs

Yield Per Hive	Price Per Pound To Cover Total Costs (cents)
140	61.43
155	55.25
170	51.87
185	45.93
200	42.29
215	39.17
230	36.46

Source: Andruchow 1981: Table 8.

MANAGEMENT OF PUBLIC LANDS

Since more land is now required in the Peace River region to form a viable farming unit, there are heavier demands on the relatively cheaper public lands. For most beginning farmers and second-generation farmers, only public lands are affordable since developed private lands of good quality are rarely transferred. However, if private lands are for sale, established farmers do not have much difficulty in outbidding the new entrants (Hanus 1980:61).

Provincial public lands are managed by the Public Lands Division within the settled areas and by the Alberta Forest Service in the forested areas of Alberta. The administration of public lands is based on a division of the province into three zones, namely, the White, Yellow, and Green areas. The White Area is the initially settled area of Alberta and does not include the Peace River region. The Yellow Area is located within the boundaries of the Peace River region and allows for homestead sale dispositions on suitable lands. The Green Area encompasses the non-settled forest lands and is managed for multiple uses, including energy resource extraction, forest production, watershed protection, and recreation.

Permanent settlement and agricultural uses other than livestock grazing have been restricted in the Green Area (Alberta Energy and Natural Resources 1981a:1).

Grazing Leases

Grazing lands may be leased for a period of five to ten years and are limited in size to an area which will support 600 head of cattle on a 12-month basis (Alberta Energy and Natural Resources 1981a:11). The lessee must pay taxes directly to the municipality and rent is calculated as a percentage of the forage value of the lease. Forage value, in turn, is calculated by multiplying the weighted average price of beef cattle by the average gain of cattle on grass and dividing by the carrying capacity of the land (Alberta Energy and Natural Resources 1981b). The percentage of forage value used to calculate the 1981 rental is 5 percent

Table 13. Farm taxfilers' average net income by source and by level of gross farm income in 1974, Census Division 15

Gross Farm Income \$	Taxfilers Reporting No.	Wages & Salaries \$	Business Income \$	Rental & Investment		Farm Taxfilers			Total Income \$	Average Age	
				Income \$	Other Income \$	Total Off-Farm Income \$	Reporting Off-Farm Income No.	Farm Income \$			Gross Farm Income \$
0 or No Response	385	13268	1903	728	917	16817	380	-2928	0	13888	37
1 to 2499	1620	10643	916	556	877	12992	1595	-2484	1108	10508	42
2500 to 4999	990	8924	862	624	852	11262	935	-1883	3682	9379	44
5000 to 7499	785	7565	1140	593	845	10142	755	-1146	6229	8996	44
7500 to 9999	600	5897	711	700	662	7970	560	-406	8694	7564	44
10000 to 12499	540	5831	696	621	671	7819	510	55	11192	7874	45
12500 to 14999	440	5035	773	630	699	7137	415	569	13713	7706	44
15000 to 17499	380	4645	742	574	604	6565	365	1011	16223	7575	45
17500 to 19999	335	4249	491	683	600	6024	320	1990	18731	8014	45
20000 to 22499	290	2876	394	603	601	4474	280	2411	21242	6884	45
22500 to 24999	285	3529	970	694	766	5959	275	3155	23630	9114	45
25000 to 29999	440	2927	265	673	556	4421	420	4662	27366	9084	44
30000 to 34999	340	2213	477	1161	605	4455	325	5319	32372	9774	45
35000 to 39999	300	1728	289	904	550	3471	295	6242	37559	9713	43
40000 to 44999	275	1501	185	1119	606	3410	270	7144	42467	10554	45
45000 to 49999	205	1981	-91	1284	642	3815	200	9868	47441	13683	46
50000 and over	965	1599	412	1371	751	4133	935	12547	93091	16680	43
Average of all Farm Taxfilers	9175	6101	735	760	742	8338	8840	1809	21640	10148	44

Source: IEC 1980: Table A21.

for the North District (includes all of the Peace River region). The rental charges are listed in Table 14. The grazing lands must have a carry-over (forage not used in the current growing season) of about half the year's growth of forage to prevent damage from overuse.

Grazing Permits

Grazing permits are issued annually and terminate on December 31st subsequent to the date of issue. This type of lease arrangement is usually made on lands under reservation for another purpose. The rental charges are the same as for the grazing lease and permittees must pay municipal taxes (Alberta Energy and Natural Resources 1981a:12).

Grazing Association Leases

Community pastures, or grazing association leases, may be established by five or more stockmen who are incorporated under The Societies Act or The Co-operative Associations Act. Members of the association are responsible for fencing, range improvement, and water development and must pay the lease rental charge along with municipal taxes. Unlike individuals, the association is not limited in the size of area under lease (Alberta Energy and Natural Resources 1981a:12).

Forest Grazing Licences

Forest grazing licences are grazing dispositions issued for a period of up to 10 years on public forested land in the Green Area. The licence is subject to the management plan if it falls within a forest management agreement area. Holders of this type of disposition are charged a per head per month fee equivalent to the amount paid for grazing lease rental. Licensees outside the forest management agreement areas must pay municipal taxes (Alberta Energy and Natural Resources 1981a:20).

Table 14. Rental per acre in the North District for 1981

Carrying Capacity	Rental per Acre (cents)
24	44.5
32	33.5
40	26.75
50	21.5
60	17.75

Source: Alberta Energy and Natural Resources 1981b

Provincial Grazing Reserves

The Public Lands Division has established provincial grazing reserves which are in fact community pastures used by local farmers. Reserves of this sort are generally located on lands requiring large investments for development. Such outlays are beyond the means of individual farmers and thus financing is undertaken by the provincial government. The 1980-81 costs on a per acre basis for clearing and piling averaged \$70, burning and piling averaged \$50, and cultivating and seeding averaged \$40. Hence the total average cost of bringing land into production on a provincial grazing reserve was \$160 per acre (Cooke 1981: personal communication). Rental is charged on a per head per month basis and calculated according to the equivalent lease rental fee, municipal taxation costs, and the cost of pasture operation (Alberta Energy and Natural Resources 1981a:35). In 1980 four grazing reserves were in operation in the Peace River region: Kleskun Lake (12,800 acres), Wanham (18,735 acres), Whitemud (24,160 acres), and Valleyview (13,100 acres). Twenty-six million dollars is being provided over a 10-year period under the Heritage Savings Trust Fund program for development of new grazing reserves in central and northern Alberta in the Grey Wooded soil zones (Alberta Energy and Natural Resources 1981a:36). In the Peace River region, the grazing reserves not yet operational are located at Bear Canyon, Blueberry Mountain, Fort Vermilion, High Prairie, Manning, and Three Creeks. For more detailed information on land area and utilization of grazing reserves in the Peace River region, see Appendix B, Table B6.

Homesteading

In the Yellow Area, suitable land is available for homesteading in the Grande Prairie-Peace River-High Level region. The applicant may apply for a homestead sale encompassing not more than four adjoining or cornering quarter sections of land as a unit. More than one homestead sale may be applied for if each unit is within a 10-mile radius of each other unit, but no more than a total of four quarter sections may be acquired. If the applicant owns other land, the combined area of the land already owned and applied for as a homestead sale cannot exceed four quarter sections (Alberta Energy and Natural Resources 1978:1). The payment toward the purchase price is established at market value for similar lands in the vicinity. Where the land contains no cultivation, interest is not payable on the principal for the first three years after the sale. Following this period, interest is charged at 6 percent per year and the maximum sale agreement is 20 years. When the purchaser has lived on or within 10 miles of the homestead for one year, has brought an area of 40 acres per quarter section under cultivation, and has paid the full purchase price, he may obtain title. Lands classified under homestead sale may be assigned, or the interest held in public lands may be transferred by the disposition holder, if the purchaser has fulfilled homestead duties for two years and paid the required instalments on the purchase price (Alberta Energy and Natural Resources 1981a:9-10). Public land is allocated primarily to applicants already engaged in agriculture who wish to expand their holdings to form an economic farming unit. Other qualified applicants are local people seeking to establish new farm units (for example, second-generation farmers) and non-local people who can demonstrate their ability to operate a successful farming operation (Alberta Energy and Natural Resources 1981a:8).

Public Land Disposition Process

The public land disposition process involves applying for a parcel of land, inspecting the land (by the Lands Division), posting the land, interviewing the applicants, providing an interim award of the land to an applicant, providing for appeals to a local Agricultural Development Committee, and providing the final award of the land to a successful applicant (Hanus 1980:65). Usually all of the above steps are followed because of the high demand for land in the Peace River region. In fact, there are often from three to 20 applicants for a parcel of land (Klippenstein 1981: personal communication). Appeals must be submitted within 30 days of notification of an interim award, but it often takes one year before an appeal reaches the Agricultural Development Committee. The committee serves as an appeal board for applicants who are dissatisfied with the interim decisions of the Lands Division. Members of the committee, consisting of farmers, businessmen, and government employees, provide the Lands Division with recommendations based on their consensus of the most deserving party. But the final award decision is made by the Lands Division (Hanus 1980:68). Since only one applicant receives the public land disposition, there are often complaints from the unsuccessful applicants regarding the biases of the Agricultural Development Committee's recommendations (Klippenstein 1981: personal communication).

With the heavy demand for land, it is difficult to keep the farmers satisfied under the present land allocation system. A new procedure has been tried in La Crete, based on the recommendations arrived at during a local public meeting. Four townships southeast of La Crete were surveyed from which 50 units were established covering an average of three-quarters of a section, each ranging from a half to an entire section. The parcels were all posted at one time and the names of applicants qualified for farming the land, as determined by personal interview, were put in a draw. Those who did not qualify were able to appeal and were put in the draw if the appeal was upheld. There were over four times the number of people in the draw as the amount of land available. However, the people *in* the draw felt it was fair. This procedure for land disposition has also been tried in Valleyview and may become more widespread in the years to come for public lands which are being made available for new settlement (Klippenstein 1981: personal communication).

New development on Crown lands has not increased in recent years according to the Lands Division. In the 1960s, an average of about one and one half townships (34,560 acres) were opened for homestead sale or lease each year. Approximately 1,903 to 22,981 acres were opened up annually between 1970 and 1980, reflecting a slower rate of development. Indeed, no new land was opened for homestead or farm development sale leasing during five years of the past decade (Lindsay et al. 1981:354).

The Northern Alberta Development Council states that the government policy of opening up small parcels at the fringe of existing developed areas does not alleviate servicing or land management problems such as erosion. The council proposes an alternative system whereby land would be developed on a larger scale, around natural land characteristics. They suggest a basic farm unit size of 1,000 acres to capture farm machinery economies and productivity benefits (Northern Alberta Development Council 1978:39).

Reclassification of Land

The demand for unopened land is concentrated mainly in the Green Area and thus every parcel proposed for agricultural development must be considered by Alberta Energy and Natural Resources. This department considers the impact of removing forest reserves for agricultural operations and ultimately determines the most suitable use for the land (Nichols 1981:76). Reclassification of land from one area to another is executed by means of an order of the Associate Minister of Public Lands and Wildlife. From 1976 to 1979, approximately 17,280 acres were transferred from the Yellow Area to the Green Area (Thompson 1981a:11). This reflects the department's concern for maintaining and expanding the forest industry, resulting in the removal of some presumably non-arable land from possible agricultural expansion along the agriculture/forestry fringe area. Between 1976 and 1979, roughly 3,040 acres were transferred from the Green Area to the Yellow Area for agricultural expansion (Thompson 1981a:11). From June 1979 to September 1980, 4,480 acres were transferred from the Green Area to the Yellow Area, which represents a slightly higher rate of recent development (Alberta Forest Service 1981).

POTENTIALLY ARABLE LAND

The potentially arable land in the Peace River region has less than 50 percent of the inherent productive capability of land having the same CLI classification in southern and central Alberta. The amount of potentially arable land that is put into production is determined by farm product prices and yield relative to land improvement and production costs. Therefore more potentially arable land will become viable for use at higher relative product prices (Manning 1975:20). But non-agricultural land uses encroaching on prime agricultural land in Alberta will likely add pressure to development in the north principally through the ripple effect described earlier (see Chapter 2).

The amount of potentially arable land in the Yellow and Green areas of the Peace River region has been calculated by several researchers, resulting in a variety of estimates. Deloitte (1980) used the Alberta Energy and Natural Resources map of the Yellow, White, and Green areas in conjunction with the Canada Land Inventory (CLI) agricultural capability map. Only classes 2, 3, and 4 are considered as potentially arable, since class 1 land does not exist in the Peace River region. Including class 4 land, which has severe limitations on some types of crop production and is considered marginal for sustained cereal crop production, the total amount of land suitable for cultivation presently improved or available for improvement is 7,167,000 acres according to this estimate. There are 6,819,000 acres of this land in the Yellow Area and 348,000 acres in the Green Area (Deloitte 1980:22). Since almost 4 million of the total 7.2 million acres is already occupied, 3.1 million acres are potentially arable (left for potential improvement). Most of this potential farmland is located in Improvement District (I.D.) 16 (454,000 acres), I.D. 17 (702,000 acres), I.D. 22 (353,000 acres), and I.D. 23 (932,000 acres) (Deloitte 1980:25). This land is mainly CLI class 4.

A second study by Pettapiece and Lindsay (1981), calculated that there are 4.9 million acres of CLI class 2 and 3 land in northwestern and north-central Alberta and an additional 8.4 million acres of CLI class 4 land. By deducting the total area in farms according to 1976 census data (6.1 million acres), a total of 7.2 million acres of potentially arable land remains (4.9 plus 8.4 = 13.3 minus 6.1 = 7.2). Only 3.9 million acres of the 6.1 million acres in

farmland was improved farmland as of 1976. Assuming all this land could be converted to crop production (a highly dubious assumption), a total of 9.4 million acres (13.3 minus 3.9) of CLI class 2 to 4 land was potentially available as of the 1976 census (Pettipiece and Lindsay 1981). The most recent, and very likely the most accurate estimation of the area with agricultural potential in C.D. 15 was prepared by the departments of Energy and Natural Resources and Agriculture. In the White and Yellow areas of C.D. 15 there are 5.2 million acres of class 1 to 3 land and 2.9 million acres of class 4 land. In the Green Area (the area of the province not yet available for agricultural use) there are an additional 1.1 million acres of class 2 to 3 land and 8.5 million acres of class 4 land. Thus, the total area potentially available for crop production is 17.7 million acres in C.D. 15: 6.3 million acres of class 2 to 3 land and 11.4 million acres of class 4 land. Of the 17.7 million acres of potentially arable land, 6.1 million was already in farmsteads in 1976. This leaves a residual of 11.6 million acres still potentially available. However, it must be emphasized that 11.4 million of the 17.7 million acres are class 4 lands (marginal for sustained production of cereal crops), and 75 percent of these class 4 lands are still in the Green Area (currently unavailable for agricultural uses and much of it forest covered).

A great deal of this land may be suitable for perennial forage production, but can only be developed if markets for livestock industry products from the north can be expanded along the lines recommended by Horner (1981). However, "any further agricultural development in northwestern Canada will have to take place in areas which are marginal in terms of climate or soils" (Pettipiece and Lindsay 1981:10). The extent to which this land can be developed for agriculturally productive uses depends to a large degree on a variety of economic variables. A first step in evaluating the feasibility of agricultural production from this area should be "specific exploration leading to adequate information on the potential in these and other areas" (Horner 1981:52). One of the most significant costs involved in opening new land for agriculture is the cost of clearing and preparing the land relative to the potential net return from agricultural production.

Cost of Preparing Land for Production

In recent years, lands most commonly developed have had medium tree cover (trees up to 12 inches in diameter) since lands with light tree cover have already been brought into production. Land breaking is commonly done with either a moldboard plow or a rotovator. A cost study of both methods was conducted by Alberta Agriculture based on custom rates charged by five custom operators in the High Prairie area (Tables 15-17). The costs are for 80 to 100-acre level parcels without rocks. Rough or rolling terrain would cost an additional \$2 to \$3 per acre for brushing (Visser 1980:1). Although rotovator costs are high relative to moldboard plow costs, the former saves time because very little subsequent discing is required (University of Alberta 1971:40). Other advantages are the possible difference in the resulting soil condition and the lower labour input (Visser 1980:1).

Land clearing is done over an average period of two to three years and seeding takes place the following year. However, land development progress depends on finances and weather. It has taken up to 10 years before the seeding of the first crop in the Fort Vermilion district (Klippenstein 1981: personal communication). The custom operator is in charge of brushing and piling, repiling and either plowing once and discing twice, or rotovating once. Burning, root raking, and the final two discings are done by the landowner (Visser 1980:4).

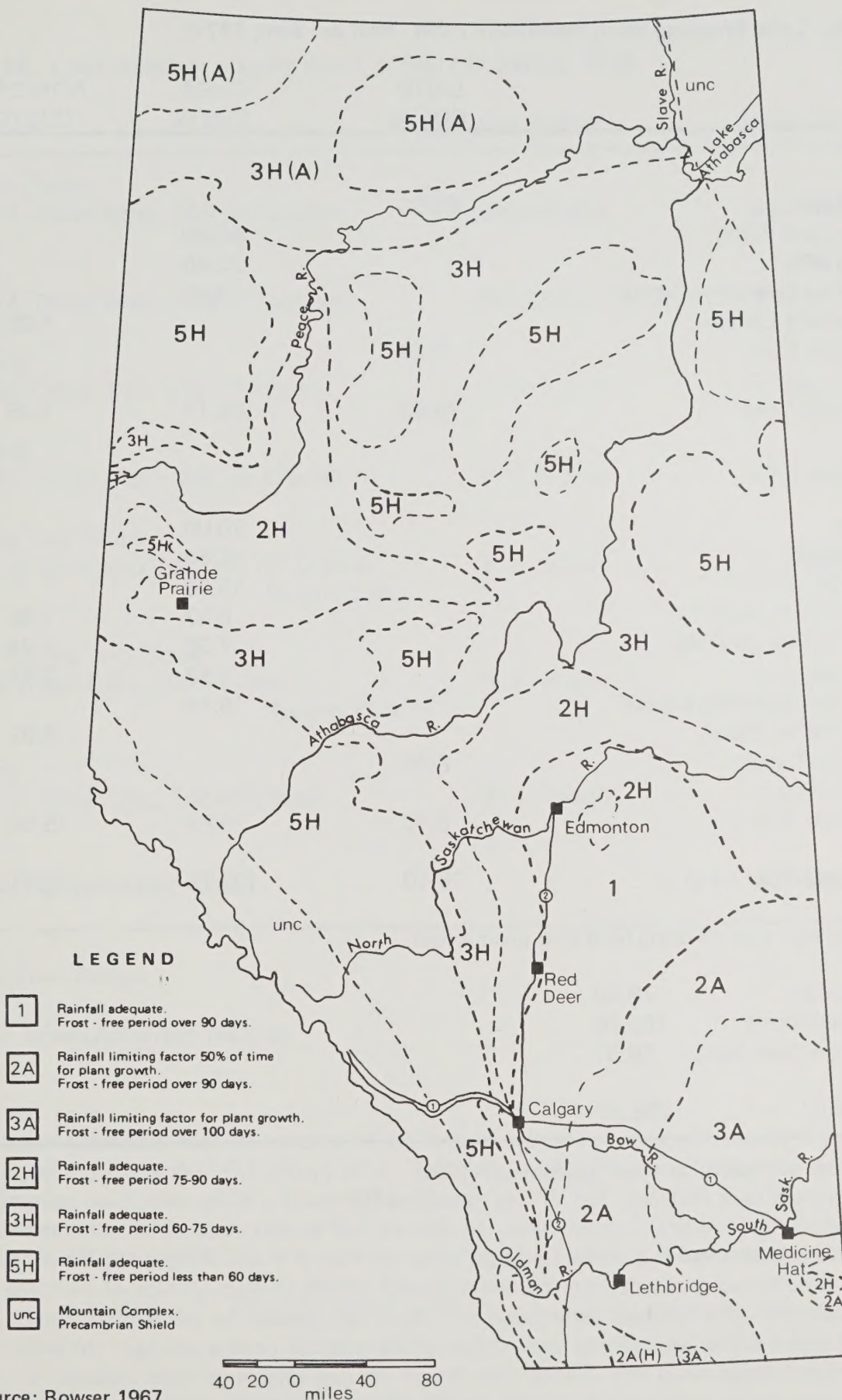
In the High Prairie study, interest on investment in land was calculated at 12 percent. Crown-owned land in the area was valued at \$10,000 per quarter section. Elsewhere in the Peace River region, Crown land made available for homesteading or farm development lease ranges from \$8,000 to \$12,000 per quarter section. Privately owned land is approximately double the price of Crown land in the Fort Vermilion district and ranges from \$15,000 to \$25,000 per quarter section (Klippenstein 1981: personal communication). Undeveloped land purchased from private sources is more expensive than land purchased from the Crown because the sale agreement does not contain any residency or development clauses (Hanus 1980:48). Table 15 is a summary of all costs involved in clearing and breaking using a moldboard plow for the land-breaking operation. When the land is privately owned, the total per acre cost of bringing land into production increases to \$336.87 (price of the land doubles to \$156.80). The total *cash* costs described in Table 15 are equivalent to those of the method of walking down, piling, and disking described in Table 16. A summary of all costs involved in clearing and breaking using a rotovator for the land breaking operation may be found in Table 17. The total per acre cost of bringing land into production if the land is privately owned (\$156.80 per acre) increases to \$345.24.

It should be noted that the above costs do not include infrastructure support expenditures such as access or roadworks, communications, education facilities, and social services. Moreover, they do not reflect the fact that the cost of land clearing depends on the level of activity of the oil industry. Because of the oil industry cutback, machinery operators are currently looking for work and thus charging lower prices. If the level of oil patch activity rises, the cost of land clearing will likely start increasing again (Monner 1981: personal communication).

Limiting Physical Properties of Grey Wooded Soils

Grey Wooded soils occur in the Peace River region in agro-climatic areas 2H and 3H, where precipitation is adequate but the frost-free period is so short that the growing season for crops is limited to 90 days or less (see Figure 2). Agro-climatic areas are grouped according to soil surface characteristics, climatic conditions, and management requirements (University of Alberta 1971:13). Since wheat requires 90 to 100 days to mature (as compared with 85 to 95 days for oats, 85 to 90 days for barley, 73 to 83 days for rapeseed), it is frosted about one year in three in the 2H agro-climatic zone and not even recommended in the 3H zone (Bentley 1978:8).

Most of the Grey Wooded soils that are cultivated in the Peace River region developed on parent materials of lacustrine clay deposits under relatively moist conditions and forest cover (University of Alberta 1971:17). These soils are generally rated as CLI class 4 and are only 49 percent as productive as class 1 soils under similar climatic conditions (Alberta Agriculture n.d.:89). More careful management practices are required for crop production on Grey Wooded soils because of the low organic matter content. The lack of organic matter adversely affects the soils' water-holding capacity, causing them to dry out relatively quickly during times of drought. Finer textured soils are affected by the timing of tillage: they powder if cultivated when too dry and puddle if tilled when too wet. Many soils require high application rates of nitrogen fertilizer soon after they are brought into production because of their low level of fertility. Fertilizer also improves the nutritive value of crops grown on the less productive Grey Wooded soils (University of Alberta 1971:53, 56).



Source: Bowser 1967

Figure 2. Agro-climatic Areas of Alberta

Table 15. Land breaking using moldboard plow - cost per acre, 1979

	LAND COSTS	CASH COSTS	NON-CASH COSTS
Year 1			
Virgin Land	62.50		
Brushing and Piling		60.00	
Plowing 80%		22.40	
Interest on Operating Capital		5.77	
Landowner's Labour			1.25
Interest on Land	7.50		
Total Costs Year 1	70.00	88.17	1.25
Year 2			
Repiling		20.00	
Plowing 20%		5.60	
Discing 2x		15.00	
Raking (Drum rake) 1x		8.27	1.46
Raking (Wheel rake) 2x		7.06	1.74
Discing 2x		3.18	2.94
Interest on Operating Capital		16.48	
Landowner's Labour			8.92
Interest on Land	8.40		
Total Costs Year 2	8.40	75.59	15.06
Total Costs Year 1 and 2	78.40	163.76	16.31
Total per acre cost to bring land into production:			
Land*	78.40		
Cash Costs	163.76		
Non-Cash Costs	16.31		
Total	258.47		

* Land cost estimates for the High Prairie region.

Source: Visser 1980: Table 1.

Table 16. Land breaking: walking down, piling, and discing, 1979

Procedure	Cost Range	Cost Estimate
Walking Down		
14' Dozer Blade, 300 HP Crawler	\$33-45/acre	\$40/acre
Piling		
14' Dozer Blade, 300 HP Crawler	\$56-84/acre	\$70/acre
Breaking		
12' Offset Disc, 275 HP Wheel	\$ 9 -11/acre	\$10/acre
Repiling		
13' Dozer Blade, 200 HP Crawler	\$17-22/acre	\$20/acre
Discing Two Times		
12' Medium Offset, 140 HP Crawler	\$ 5 - 6/acre	\$ 5/acre
Second Time		\$ 5/acre
Root Raking Two Times		
5 Wheel Rake, 60 HP Wheel	\$ 4 - 6/acre	\$ 5/acre
Second Time		\$ 5/acre
Discing		
12' Offset Disc, 140 HP Wheel	\$ 4 - 6/acre	\$ 4.50/acre
TOTAL ESTIMATED COST		\$164.50/acre

Peace River Region

Source: Alberta Agriculture 1981c:30

It has been estimated that 31 percent of the Peace River soils, or approximately 1.2 million acres, have a pH less than 6.1 (Hoyt et al. 1981:54). Soil acidity is expressed in pH units: pH 7 implies neutrality while a lower pH indicates acidity (pH units are expressed as logarithmic functions with each rise or fall of one pH unit representing a 10-fold change in acidity). A pH between 6 and 8 is best for growing crops while a pH of less than 6 affects crops sensitive to acidity, such as alfalfa. Several crops are restricted in production if the pH is less than 5 (University of Alberta 1971:33). For many Grey Wooded soils, the plow layer has a higher pH than the subsoil. Consequently, either deep cultivation, which mixes the soil layers, or erosion leading to the loss of topsoil can acidify the plow layer (Hoyt et al. 1981:53). The increasing use of nitrogen fertilizers adds to the problem of soil acidity, and

Table 17. Land breaking using rotovator - cost per acre, 1979

	LAND COSTS	CASH COSTS	NON-CASH COSTS
Year 1			
Virgin Land	62.50		
Brushing and Piling		60.00	
Rotovating 80%		48.00	
Interest on Operating Capital		7.56	
Landowner's Labour			1.25
Interest on Land	7.50		
Total Costs Year 1	70.00	115.56	1.25
Year 2			
Repiling		20.00	
Rotovating 20%		12.00	
Raking (Wheel rake) 2x		7.06	1.74
Discing 2x		3.18	2.94
Interest on Operating Capital		19.13	
Landowner's Labour			5.58
Interest on Land	8.40		
Total Costs Year 2	8.40	61.37	10.26
Total Cost Year 1 and Year 2	78.40	176.93	11.51

Total per acre cost to bring land into production:

Land*	78.40
Cash Costs	176.93
Non-Cash Costs	11.51
Total	266.84

*Land cost estimates for the High Prairie region.

Source: Visser 1980: Table 2.

is said to be "the major cause of acidification in Western Canada" (Hoyt et al. 1981:41). Fortunately, the response to lime appears to be the same whether the soil is naturally acid or acidified by fertilizers or industrial sulphur dioxide.

Soil acidity may be adjusted to by growing acid-tolerant crops such as oats, flax, and grasses in the interim before lime is applied. But no management practice other than liming will lessen soil acidity. Unfortunately, the sources of lime are located far from agricultural areas: near Exshaw, 100 km west of Calgary; near Hinton, 275 km west of Edmonton; and near Blairmore, 125 km west of Lethbridge (Hoyt et al. 1981:62-63). The Alberta Research Council, in co-operation with Alberta Agriculture, has been investigating possible sources of marl (a crumbly deposit of sand, silt, or clay containing a substantial percentage of calcium carbonate) in the Peace River region. The largest find, near Grimshaw, contains enough marl for an application of one ton per acre for less than five percent of the estimated acreage in the Peace River region with soil pH less than 6.5. Lime costs from \$9.10 to \$13.60 per ton at the source. Transportation ranges between \$13.60 and \$18.15 per ton depending on location, which is greater than the cost of the lime itself. But in remote locations such as Fort Vermilion, transportation costs could total \$36.60 per ton. The application cost including hauling to the farm from storage depots ranges from \$1.80 to \$9.10 per ton. Liming thus costs approximately \$27.20 to \$36.30 per ton, taking the mid-point of the average costs (Hoyt et al. 1981:63). The amount of lime required depends on the level of soil acidity but the minimum is usually one ton per acre. One liming application may last up to 10 years in the Peace River region. According to some estimates, alfalfa could be grown after two years. Therefore, after one or two years, all yield increases are in fact net returns with respect to the initial cost of liming (Hoyt et al. 1981:65). Unfortunately, the farmer hesitates to use lime because of the high cost of the first treatment and the time that must elapse before there are any benefits. Because the price of transportation is higher than the cost of the lime and its application, a provincial lime transportation assistance program has been initiated. Alberta Agriculture will pay 80 percent of any freight costs above \$5 per ton regardless of the distance from the source of lime to the farm site.

Poor management practices in the Peace River region contribute to the deterioration of Grey Wooded soils. Summerfallowing, for example, breaks down the soil structure due to exposure to the weather and should rarely be used during severe droughts (Alberta Agriculture n.d.:35). The acreage in summerfallow, however, has declined at a faster rate in the Peace River region than in Alberta as a whole over the past four years. In 1981, 575,000 acres were in summerfallow as compared to 877,000 acres in 1978 (see Appendix B, Table B2). The most suitable cropping pattern for the region consists of two to three years of leguminous forage crops to provide nitrogen to the soil, followed by two to three years of cereal or oilseed crops (University of Alberta 1971:48-49). But mixed farming (crop and livestock production) will have to become more viable for this type of continuous cropping pattern to prevail, since local markets for forage will remain small without more locally raised livestock and transportation costs to southern markets are high.

GRAIN HANDLING AND TRANSPORTATION SYSTEM

The primary elevator is the most important element of the present grain handling and storage system. A large portion of the grain handled by primary elevators is transported by

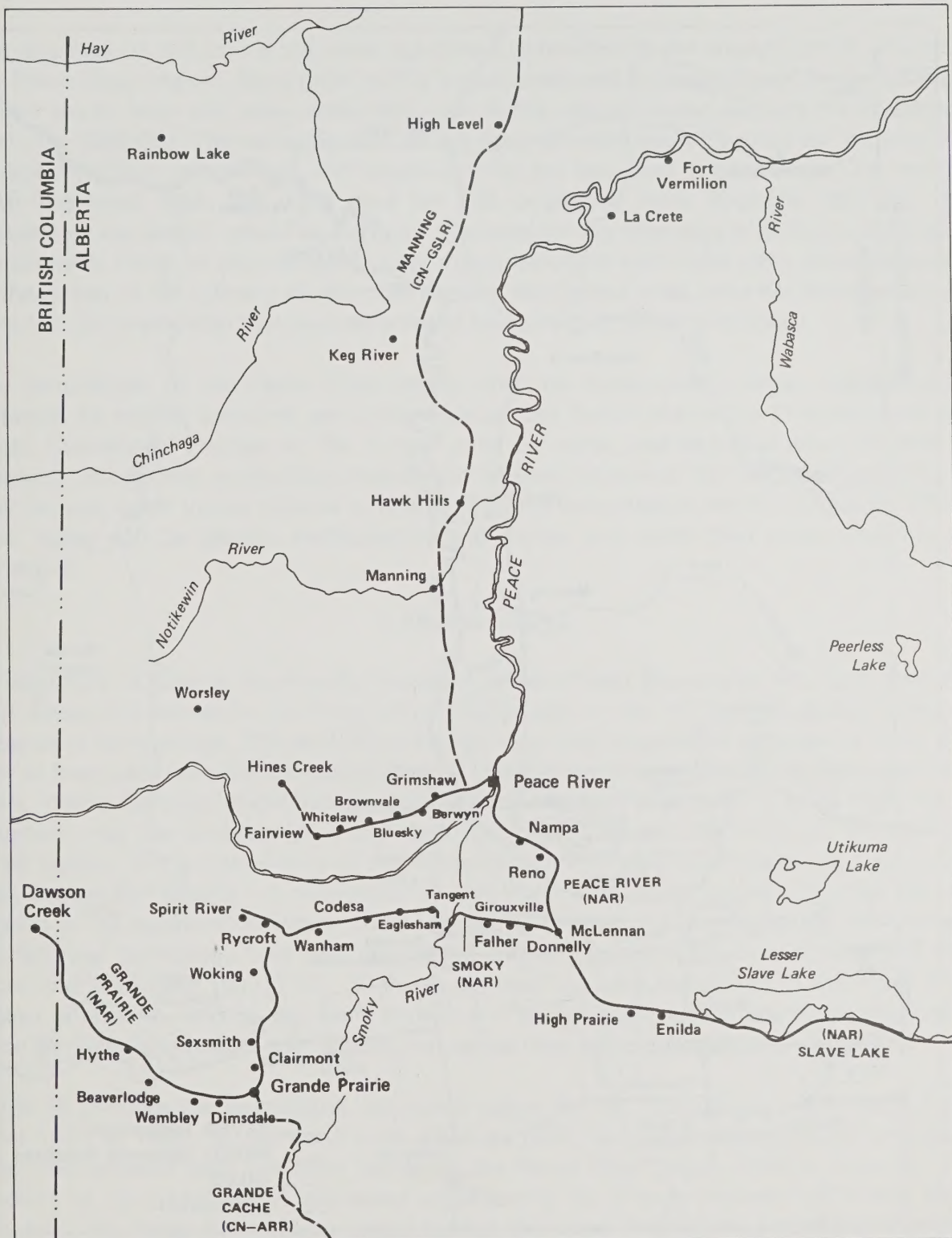
rail to port terminal elevators for export, although rapeseed is sent by truck to the Northern Alberta Rapeseed Processors plant in Sexsmith. There are 104 licensed primary elevators located at 33 delivery points in the Peace River region. Alberta Wheat Pool owns the majority, followed by United Grain Growers and Cargill (Deloitte 1980:42). At 13 delivery points, only one company operates. There may be less competition in the future if the trend towards consolidation of primary elevators in areas of overlapping services continues.

The railway is almost the exclusive means of grain transportation in the Peace River region since the Crow rate is approximately one-tenth the rate charged by commercial highway carriers (Deloitte 1980:54). Two railway companies serve the region: the Canadian National Railway (CNR) and the Northern Alberta Railway (NAR). The CNR owns and operates the Great Slave Lake Branch (GSL). The Alberta government owns the Alberta Resources Railway (ARR) while the CNR operates it under contract. Ownership of the NAR is equally divided between the CNR and the Canadian Pacific Railway (CPR) although the railway itself is independently operated (Deloitte 1980:55). For the location of the three railway lines, see Figure 3. Edmonton and Grande Prairie act as gateways to the Peace River region with the former receiving 77 percent of the traffic and the latter, 23 percent. Most of the total traffic handled by the NAR and the GSL branch (93 percent) is outbound because of the high volume of resource commodities leaving the region (Deloitte 1980:63). Inbound commodities are sent primarily by highway transport. Approximately 60 percent of the grain is transported to the Vancouver and Prince Rupert ports for export while the balance is sent to eastern ports and the domestic market (Deloitte 1980:65-66).

The road system in the Peace River region provides all grain-producing areas with access to the regional and national transportation systems. Both the location and quality of roads are indicated in Figure 4. Sub-regions far removed from railway lines, such as the Fort Vermilion-La Crete area and the Worsley area, are serviced by roads of low quality. La Crete farmers must travel up to 75 miles over the occasionally impassable roads of Highway 58 to move their grain to the primary elevator in High Level. During wet intervals, some gravelled sections of Highway 64 are impassable in the Worsley area (Deloitte 1980:78). Indeed, about 250 miles of primary highways require upgrading at a total cost of \$140 million. Roughly 160 miles of secondary roads could also require upgrading at a total cost of \$20 million. Currently, Highways 58 and 64 are being upgraded and they together comprise more than 60 percent of the requirements for the improvement of primary highways (Deloitte 1980:121-122).

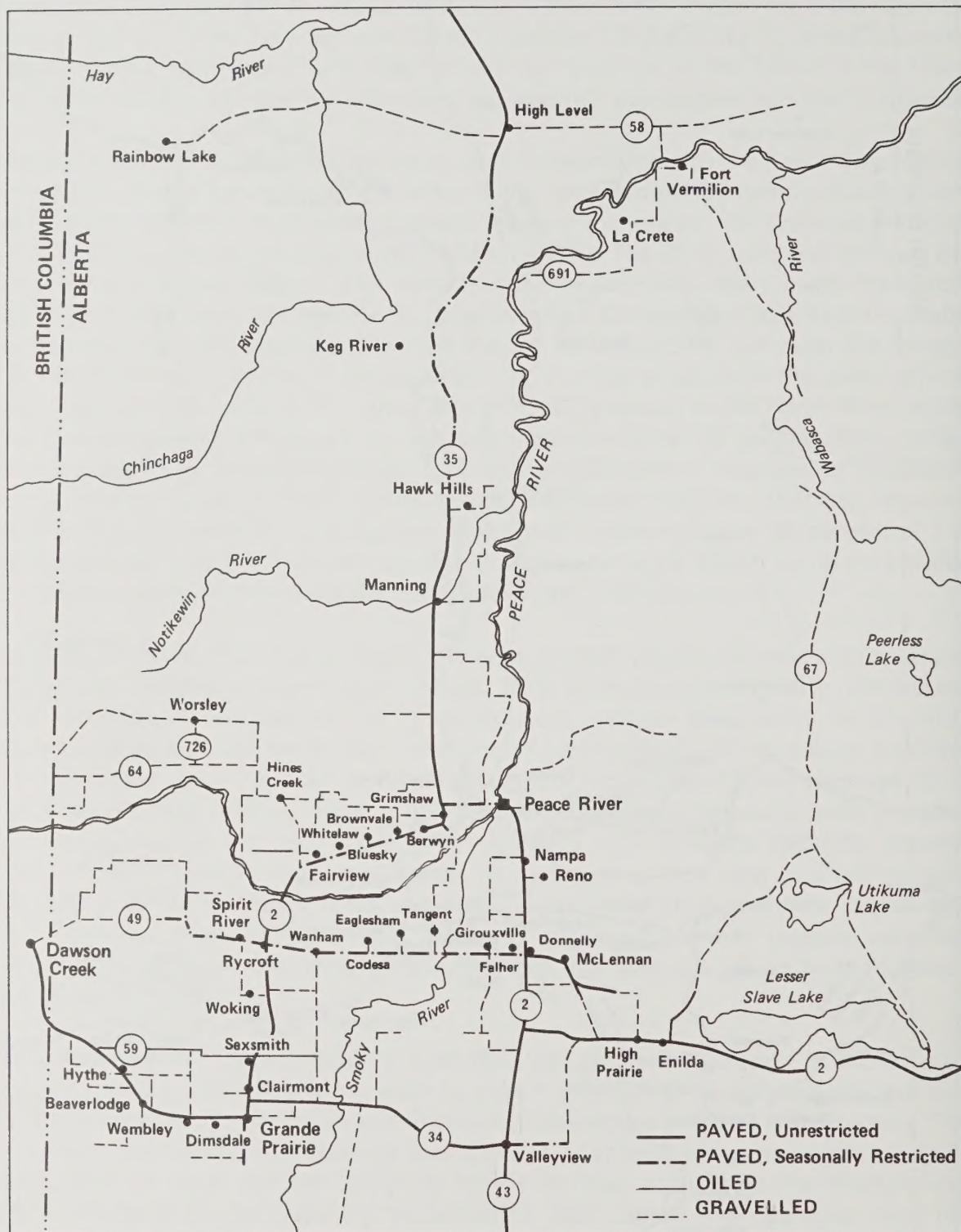
The grain handling and transportation system does not perform efficiently in the areas of collecting, preparing, and transporting grain to export position or to the domestic market. Part of the problem resides in the diverse interests of the parties involved in the system. The farmer wishes to maximize his return to management or at least his gross margin to cover operating costs; the grain elevator company strives to make a profit on the handling and disposition of the grain; railways try to minimize their capital and operating costs for transporting grain to offset the non-compensatory effect of the Crow rate (see Chapter 6).

The grain-handling system does not adequately service the Valleyview, Worsley, and Fort Vermilion-La Crete areas. Farms must haul their grain to primary elevators located 35 to 80 miles away and on less than satisfactory roads in the latter two areas. But elevator operators are unwilling to incur the added costs of establishing elevators at the above three locations.



Source: Deloitte 1980:Figure 1

Figure 3. Northern Railway Lines



Source: Deloitte 1980:Figure L

Figure 4. Northern Highway System

Throughout the remainder of the region, the average distance from elevators is about 12 miles (Deloitte 1980:83).

The shortage of rail cars is the most significant deficiency in the transportation system in the Peace River region. Since grain traffic is not considered to be profitable by the railways, capital works have not been undertaken for traffic which cannot support the investment (Deloitte 1980:85). The car cycle time, or the time between loading a grain car, moving it to its delivery point, unloading it, and returning it for the next load, is on average 13.6 days for NAR-originated loads and 16.6 days for GSL-originated loads (Deloitte 1980:86). The problem of car supply would be partially alleviated by any operating plan that could reduce the car cycle time. An improvement in car supply would in turn make more storage available to the farmer at the primary elevator. At present, the farmer must carry his inventory on the farm for over a year and this involves a heavy investment in on-farm storage.

The remoteness of the Peace River region and the consequently longer transportation distances to export locations are constraints on the future marketing of agricultural products. Operational changes in the system must be made, and technical advances must be adopted, before crop production increases in volume. Improved rail links to Prince Rupert may depend upon future mineral or energy resource extraction in northern Alberta. Otherwise, there will be greater inefficiencies and higher unit costs than those presently experienced.

LAND VALUES

As elsewhere in Alberta, the steadily increasing prices of land (because of non-farm demands) near expanding towns in the Peace River region add to the difficulties of the farmer in expanding his holdings. This problem is crucial since land acquisition is necessary more than ever to keep pace with the increasing scale of farming operations dictated by high machinery costs. Rising farmland prices may also be attributed to farm expansion to bring other family members into the business (Jose and Markland 1981:114) and the influx of farmers from other regions. The greater degree of risk of farming in the Peace River region (in conjunction with lower land quality) is manifested in the lower land prices relative to other farming regions in the province. However, there is evidence that returns from adopting yield-increasing fertilizer technology have been capitalized into land values in the Grey Wooded soil zone (Jose and Markland 1981:114). If this is so, land has been overpriced in the Peace River region relative to land in the Dark Brown and Brown soil zones of south-central Alberta since fertilizer application is an annual cost rather than a one-time capital investment.

Table 18 provides the agricultural real estate values for the Peace River region and Alberta from 1971 to 1980. In 1974 and from 1976 to 1980, the percentage change in land values from the previous year has been higher in the Peace River region than in Alberta. The amount of land transferred decreased significantly in Alberta between 1973 and 1977. However, the Peace River region lagged behind this trend. Indeed, the percentage change in land transferred from the previous year in the Peace River region was 35.6 in 1975 as compared to -5.5 in Alberta. In 1980, the number of acres transferred declined by 8.4 percent from the average of the previous year in Alberta as a whole whereas the rate of decline was only 1.9 percent in the Peace River region. The value of land for CLI classes 2 to 6 for the Peace River region is indicated in Table 19. Land values especially have increased

Table 18. Agricultural real estate values Peace River and Alberta*

Year	Area	Average Value Per Acre of Land (\$)	Index of Land Prices 1971=100	Acres Transferred	% Change From Previous Year	
					Value	Land
1971	Peace River	43.29	100.0	158,051	n.a.	n.a.
	Alberta	67.32	100.0	2,114,025	n.a.	n.a.
1972	Peace River	50.15	115.8	190,607	+15.8	+20.6
	Alberta	83.10	123.4	2,334,484	+23.4	+10.4
1973	Peace River	54.41	125.7	210,573	+ 8.5	+10.5
	Alberta	91.72	136.2	3,218,223	+10.4	+37.9
1974	Peace River	71.71	165.6	366,452	+31.8	+74.0
	Alberta	118.92	176.6	3,328,960	+29.7	+ 3.4
1975	Peace River	82.42	190.4	496,967	+14.9	+35.6
	Alberta	144.83	215.1	3,146,075	+21.8	- 5.5
1976	Peace River	102.31	236.3	468,985	+24.1	- 5.6
	Alberta	177.39	263.5	2,959,710	+22.5	- 5.9
1977	Peace River	125.40	289.7	452,016	+22.6	- 3.6
	Alberta	213.39	317.0	2,699,518	+20.3	- 8.7
1978	Peace River	164.61	380.2	494,016	+31.3	+ 9.3
	Alberta	269.12	399.8	2,891,027	+26.1	+ 7.1
1979	Peace River	200.16	462.4	516,009	+21.6	+ 4.4
	Alberta	323.84	481.0	2,929,154	+20.3	+ 1.3
1980	Peace River	259.94	600.5	506,262	+29.9	- 1.9
	Alberta	385.61	577.8	2,681,710	+19.1	- 8.4

*Values based on sales of parcels greater than 60 acres and valued between \$5 and \$1500 per acre.

Sources:

1. Hanus 1979: Adapted from Table 9 for Peace River 1971-1977.
2. Geldart 1979: Adapted from Table A1V for Peace River 1978.
3. Geldart 1980: Adapted from Table A1V for Peace River 1979.
4. Miller 1981: Adapted from Table 7 for Alberta 1971-1980 and Table 14 for Peace River 1980.

Table 19. Value per acre by CLI classes 1 to 6 for Census Division 15

CLI Class	Value Per Acre (dollars)		% Change 1979 to 1980
	1979	1980	
1	-	-	-
2	251.33	303.73	+20.85
3	191.41	244.55	+27.76
4	173.41	203.89	+17.58
5	170.95	202.61	+18.52
6	166.63	235.95	+41.60

Source: Miller 1981: Table 13.

over the 1979 average for CLI classes 3 and 6. The increase in value of class 6 land reflects the greater interest in grazing land.

SUMMARY

Development of the agricultural potential in the Peace River region will increase with optimum use of fertilizers, adoption of suitable cropping patterns including forage crops, good prices for agricultural products, and improvement in the movement of cereal and oilseed crops to domestic or export markets. However, the Peace River region faces major economic constraints to agricultural development. The most important limiting factors are the variable climate, less productive land requiring relatively high inputs, distance from markets and even local elevators, and generally higher per unit costs as compared to more southerly regions. Any modification of the Crow rate placing more of the cost burden on the producer could retard agricultural development in the Peace region due to the long distances to market and the lack of a direct rail link to Prince Rupert. Nevertheless, future agricultural development will depend upon the rate of loss of agricultural land in southern and central Alberta, an improvement in the price/cost relationship of bringing land into production, and increased world market demand with higher prices.

There may be as much as 11.6 million acres of potentially arable land in the Peace district, but the bulk of this undeveloped land is rated class 4 by the CLI (89 percent of the potential farmland in the Green Area is class 4 land). The land has less than half the natural productivity of lands of similar capabilities in central Alberta and more than half the potentially arable land in the Yellow Area of the region is located in the most northern and eastern districts where conditions are most difficult (932,000 acres in I.D. 23 and 702,000 in I.D. 17). Increasing marginal cropland area in northern Alberta to maintain our agricultural land base while

removing prime land from production in central and southern Alberta is gambling with the future. Virtually all costs of production, handling, and transportation are higher in the north, yields are lower and even minor climatic variations could make the region unproductive. Agricultural development of the Peace region should continue as long as it remains economically viable, but future development of the region may not be capable of substituting for prime land taken out of production in central and southern regions of the province.

INPUTS TO AGRICULTURE

Since the 1940s, the mix of inputs employed in agricultural production has changed considerably because of the technological advances adopted by the farmer. The choice of inputs in evolving agricultural practices has had an impact on the level of productivity, the "cost/price" squeeze, the reliance on depleting fossil fuel resources, and the environment.

THE LEVEL OF PRODUCTIVITY

Agricultural productivity, the ratio of output produced per unit of input, measures the degree of efficiency attained by combining inputs. The choice of inputs is governed by available technology and the relative prices of capital and labour.

Between 1950 and 1972, the relatively favourable price of capital technology led to substantial purchases of off-farm inputs such as machinery, fertilizers, and herbicides as substitutes for more costly land and labour (Furton and Thompson 1980). Indeed, mechanical and chemical technology changed the structure and size of farms. The benefits of major innovations, in the form of larger and more efficient farm equipment, accrued to those farmers who discarded more costly labour-intensive techniques, acquired less labour-intensive machinery, or increased the size of their holdings. The larger scale farmer's gain in productivity represented a reduction in real costs of production. However, increased output per unit of input, resulting in a higher level of total output, tended to depress farm product prices and lower farm revenues because of the low price elasticity of demand for agricultural products (Furniss 1970:23).

With the recent upward surge in costs for high-yield technology and the rapid rise in land values, the historic productivity benefits associated with capital substitution for labour appear to have levelled off. It is questionable whether the increased output per worker under a capital-intensive system is high enough to offset the required capital inputs that replace labour. In fact, an index accounting for all inputs, such as an index of the price-deflated output per unit of price-deflated inputs (the latter including building and fencing, hired labour, machinery, and crop and animal production (Shute 1975:1)), has shown a decline in agricultural productivity on the prairies between 1962 and 1974. According to D.M. Shute (1975:2) output increased during these years by an annual rate of 1.1 percent whereas production inputs increased by 1.4 percent per year, giving an annual decline in productivity of 0.4 percent. Yields per acre for a variety of crops increased approximately 20 percent between the 1961-1970 period and 1971 to 1980, and product prices increased by 189 percent between 1961 and 1979 (see Tables 20 and 1). At the same time, input prices of all kinds went up at much higher rates (Tables 23 and 1).

There are conceptual difficulties and data problems associated with measuring all factors affecting productivity. For example, weather variability, differing farm management practices, and depreciation of farm machinery have an impact on productivity but prove difficult to measure. Nevertheless, there is evidence to indicate that the trend is toward decreasing productivity because of the relatively high cost of inputs compared with prices for outputs.

CROP PRODUCTIVENESS

There appear to be diminishing returns to increasing the productiveness, or yield per acre, of cropland through use of tractors, fertilizers, and pesticides. Between the 1951-1960 and the 1971-1980 periods, for example, there was a maximum increase of 26 percent in wheat yield, 35 percent in oats yield, 46 percent in barley yield, 21 percent in rapeseed yield, 42 percent in rye yield, and 45 percent in flaxseed yield. These increases were accompanied by a 3015 percent rise in nitrogen fertilizer use and an 800 percent rise in phosphorus fertilizer use between 1958 and 1978 (see Tables 20 and 21). There has been very little increase in yield per acre for tame hay in the past 70 years (see Table 20). Technology, therefore, appears to have had more of an impact on output per worker than on output per acre. Factors tending to reduce yield per acre include loss of topsoil from wind and water erosion, soil compaction and consequent loss of organic matter, chemical residues in the soil, climate fluctuation, and reduced incentives for agricultural research (Wittwer 1979:603). High-cost technology is thus necessary to sustain present yields of grain given the decline in soil fertility. The continued use of relatively low-yielding high-quality cultivars (especially for wheat and barley) may also be an important factor affecting crop yields. Strategies to reduce summerfallow and increase the use of lime in conjunction with fertilizer applications may lessen the problem of soil degradation. Improvements in water and snow management practices are other means of enhancing land productiveness.

THE COST/PRICE SQUEEZE

The "cost/price" squeeze, whereby revenues obtained for agricultural produce are barely sufficient to cover costs, has made farm profits more vulnerable in recent times to fluctuating prices (Heady 1976). Increasing costs of farm inputs, many of which are related to the escalating cost of fossil fuels, cannot be passed on to the consumer in the local market. It is therefore impossible for the farmer to affect prices by shifting supply. Future returns from foreign markets are difficult to predict given the high degree of competition, changing trade patterns, and the high cost of producing exportable Alberta grains (Alberta Land Use Forum 1976). A fall in real gross returns while real input costs rise will reduce the amount of money available to the farmer for reinvestment (Geno and Geno 1976:20). Hence, prices must keep pace with costs if farming a given size farm unit is to remain a viable operation, assuming productivity gains are limited. The average price of wheat was \$1.55 per bushel between 1961 and 1970 whereas in the period from 1971 to 1979, the average value rose to \$3.21 a bushel, a 107 percent increase. The prices of barley, rapeseed, rye, flaxseed, and tame hay have more than doubled in the 1971-1979 period over the 1961-1970 average (see Table 22). The costs of inputs increased by 189 percent over the same period (see Tables 23 and 1).

COST OF INPUTS

A list of farm inputs purchased in western Canadian agriculture may be found in Appendix A. A summary of the cost increases over the past nine years is listed in Table 23. The cost statistics given in this section represent list prices, so actual purchase prices may be somewhat less than these figures. However, the rate of increase in costs is the most important factor — it should be an accurate reflection of the magnitude of cost increases. The measurement of inputs is in terms of 1971 constant dollars to remove the impact of inflation, that

is, changes in the general price level. The rising index indicates that real costs of production are increasing.

Although costs of all of the farm inputs listed in Table 23 have increased significantly, the increment for crop production is particularly high because of escalating costs for crop

Table 20. Average yield for major crops in Alberta

Crop Year	Wheat	Oats	Barley (bushels per acre)	Rapeseed	Rye	Flaxseed	Tame Hay (tons)
1911-1920	17.7	36.9	25.8	-	20.0	9.1	1.41
1921-1930	18.3	32.2	24.6	-	13.3	7.7	1.44
1931-1940	15.8	30.4	23.4	-	9.7	7.7	1.57
1941-1950	16.7	32.5	23.9	-	13.4	8.2	1.49
1951-1960	22.6	41.3	29.7	-	18.9	11.1	1.50
1961-1970	23.8	46.8	35.9	15.7	19.5	13.5	1.51
1971-1980	28.4	55.7	43.4	19.0	26.9	16.1	1.79

Sources:

1. Alberta Agriculture 1974 for 1911-1971 data.
2. Unpublished data, Statistics Branch, Alberta Agriculture (February 1981) for 1972-1980 data.

Table 21. Consumption of nitrogen and phosphorus fertilizer for selected years between 1948 and 1979

Year	Nitrogen Sold (tons)	Phosphorus Sold (tons)
1948	2,424	8,155
1958	7,824	14,877
1968	100,723	96,094
1978	243,762	134,003

Source: Adapted from Jensen Engineering Ltd. 1981: Tables 3.5, 3.6.

production inputs (seed grains, fertilizers, and pesticides). The crop production inputs that could be purchased for \$100 in 1971 cost, on average, \$313.50 in 1980 (both measured in 1971 dollars). Mortgage and non-mortgage interest rose to \$466.80 between 1971 and 1980. Total farm inputs more than doubled in price, as can be seen by the overall farm inputs index of \$260.40 in 1980.

Average nominal farm input prices continued to rise in Alberta during 1980, especially for energy-related products. Farm labour per month increased by 9 percent from \$866.34 in January to \$944.44 in December. Many other non-energy related inputs also increased in price (see Appendix A, Tables A-3 and A-4). The escalating nominal costs of energy-related inputs during 1980 are summarized in Table 24. For graph trends of selected items during 1980, see Appendix A, Figures A-1 through A-6.

The price of farm machinery is rising rapidly and the substantial amount of money required for purchase is constrained by the cost/price squeeze. However, the decision of whether to

Table 22. Average farm value for major crops in Alberta

Crop Year	Wheat	Oats	Barley	Rapeseed	Rye	Flaxseed	Tame Hay (\$/ton)
(dollars per bushel)							
1911-1920	1.24	.43	.64	-	.94	1.87	12.44
1921-1930	.88	.34	.42	-	.64	1.59	11.35
1931-1940	.59	.22	.31	-	.39	1.12	7.38
1941-1950	1.32	.56	.80	-	1.41	2.91	12.04
1951-1960	1.34	.58	.84	-	.96	2.81	15.63
1961-1970	1.55	.59	.86	2.25	1.03	2.75	18.92
1971	1.30	.50	.67	2.19	.82	2.24	21.50
1972	1.84	.84	1.26	3.12	1.54	3.88	21.30
1973	4.24	1.61	2.50	5.70	2.61	9.17	36.00
1974	3.96	1.52	2.20	7.08	2.23	9.24	41.13
1975	3.51	1.42	2.31	5.18	2.64	6.51	42.50
1976	2.80	1.13	1.88	6.11	2.17	6.78	45.75
1977	2.75	.95	1.60	6.37	2.30	5.48	47.50
1978	3.66	1.02	1.72	6.32	2.55	7.29	46.50
1979	4.87	1.42	2.31	6.24	3.75	7.56	60.50
1971-1979	3.21	1.16	1.83	5.37	2.29	6.46	40.30

Sources:

1. Alberta Treasury 1980:Table 38.
2. Alberta Agriculture, Statistics Branch for 1974-1979 data.

trade in machinery is affected by a host of factors other than cost, in particular limited machine capacity, obsolescence, lower efficiency, and taxation (Andruchow 1980:114). Before buying new equipment, machinery operators are considering other alternatives such as renting, leasing, and custom work. Full-time custom operators must charge between \$2.09 and \$2.38 per acre in order to cover all costs of cultivation and maintain a sufficient profit margin to remain viable (Andruchow 1980:106). The fixed or ownership costs, which are a function of time, include depreciation, interest on investment, taxes, and insurance. Variable or operating costs, which are a function of use, include fuel, lubrication, repairs, and maintenance (Andruchow 1980). Part-time custom operators (an alternative for those farmers with high capital investment in machinery) usually cover only variable and labour costs and must charge \$1.12 per acre for an adequate return using a 200 hp tractor and a 39-foot cultivator (Andruchow 1980:106).

Table 23. Index conversion for farm inputs, western Canada 1971-1980
(1971 = 100)

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Building & Fencing	100	110.4	124.2	114.6	156.6	173.8	187.3	204.8	228.8	240.0
Machinery & Motor Vehicle	100	103.6	107.9	121.1	140.3	153.1	164.8	176.5	193.9	221.6
Machinery & Motor Vehicle Operation	100	103.8	108.7	122.0	142.1	158.0	170.2	178.7	192.9	223.4
Crop Production	100	103.7	119.7	119.7	236.6	229.5	219.7	227.4	251.2	313.5
Animal Production	100	111.6	152.7	162.3	161.0	163.2	162.4	209.5	265.4	261.8
Supplies & Services	100	103.1	109.6	121.1	136.5	150.1	161.0	172.7	190.1	205.9
Hired Farm Labour	100	108.6	124.1	148.3	176.3	203.4	225.8	239.9	254.1	272.3
Property Taxes	100	101.8	104.1	112.7	133.1	152.8	169.7	148.2	158.3	170.1
Interest	100	101.6	127.7	178.1	203.3	242.3	236.0	278.6	387.4	466.8
Farm Rent	100	127.0	140.7	159.4	244.8	252.8	220.0	228.5	245.3	268.6
Total Farm Inputs	100	107.0	125.0	145.3	164.0	176.2	181.0	202.6	237.3	260.4

Source: Adapted from the table: *Index Conversion-Farm Inputs Western Canada*, Alberta Agriculture 1981d.

IMPACT OF ENERGY-INTENSIVE INPUTS ON AGRICULTURE

Energy inputs for farming were provided by animal power in the earlier part of the century. Forage and grain that took up millions of acres of land were used as feed for the horses and mules. By 1940, farm tractors substituted for horses and the transition to modern agriculture began. Production increased substantially because of the more timely tillage and seeding operations made possible by improved farm equipment (for example, farmers could seed their entire crop during favourable weather conditions). A significant drop in labour input occurred alongside the reduction in animal use. For example, in 1930 two man-hours were required to harvest an acre of grain, but today, with energy-intensive inputs such as large tractors, fertilizers, and pesticides, this task can be accomplished in one-sixth of a man-hour (Strayer and Zoerb 1980:1).

Energy inputs in the primary agricultural sector can be divided into two categories: direct and indirect. Direct forms of energy inputs include marked or "purple" gasoline used in on-farm vehicles, clear gasoline used in private vehicles, diesel fuel, natural gas, heating oil, propane, and electricity. Fertilizers, pesticides, and machinery are indirect since a substantial amount of energy is required for their manufacture and distribution to the farm. Downing and Feldman (1974) have estimated that the energy output/input ratio in Canadian farm production is approximately 3 to 1. The energy output represents the calorific value of crops and the energy input consists of both direct and indirect energy forms (Downing and Feldman 1974:25, 27).

Table 24. 1980 Alberta farm input prices (energy related and energy products)

Input	Price in January 1980	Price in December 1980	% Increase During 1980
Tractor, 100 Horsepower	\$ 35,705.56	\$ 40,863.28	14.4
Tractor, 170 Horsepower	58,839.06	66,374.31	12.8
Combine, Self Propelled	55,994.86	65,332.69	16.6
Cultivator	6,532.46	7,754.42	18.7
Baler, Pull Type	7,058.03	8,160.97	15.6
Double Disc	6,252.35	6,723.65	7.6
Half-ton Truck	7,407.97	7,963.97	7.5
Fertilizer, 34-0-0	162.19	183.66	13.2
Fertilizer, 11-48-0	266.69	320.77	20.3
Herbicide, 2,4-D	76.54	101.54	32.7
Herbicide, Avadex BW	116.40	135.63	16.5
Purple Gasoline	64.53	84.98	31.7
Diesel Fuel	62.19	83.40	34.1
Propane	45.10	58.95	30.7
Natural Gas	1.54	1.98	28.6

Source: Adapted from Alberta Department of Agriculture 1981d.

The total food system in Canada uses 15 percent of the total energy consumed by the nation and farm production itself accounts for 2.7 percent (see column 1, Table 25). In the agricultural sector alone, farm production represents 18 percent of sector consumption (see column 2), the lowest share, two-thirds of which is direct energy use and one-third indirect energy use (Strayer and Zoerb 1980).

Although energy use in the primary agricultural sector represents a very small proportion of total Canadian energy consumption, an assured supply of fossil fuels is necessary to produce food and manufacture inputs. Modern techniques for crop production are especially vulnerable to unstable energy supplies since entire crops could be lost if there were fuel shortages during planting or harvesting (Jensen Engineering Ltd. 1981:2).

DIRECT ENERGY INPUTS

There have been shifts over the years in the forms of energy consumption in agriculture, that can be attributed to availability, convenience, prices, and government incentives (Jensen Engineering Ltd. 1981). The first major change was the replacement of animal power with gasoline-powered tractors for crop production. One of the more recent trends is the substitution of diesel engines for gasoline engines in tractors and combines, as can be seen by the decline in marked gasoline consumption and the increase in marked diesel

Table 25. Direct and indirect energy use in the Canadian food system, 1975

Sub-Sector	Percent of Total Energy Consumed in Canada Used For Food Production (1)	Percent Agriculture Sector of Total Energy Use For Food Production (2)	Agriculture Sector Use (10 ¹² BTU) (3)
Farm Production	2.7	18	254.7
Processing and Packaging	4.8	32	452.8
Transportation and Distribution	3.0	20	283.0
Home Preparation	4.5	30	424.5
Total	15.0	100	1,415.0

Source: Strayer and Zoerb 1980: Table 2.

purchase (see Table 26). There was a 4.8 percent drop in marked gasoline consumption from 1975-76 to 1979-80 whereas diesel consumption rose 29 percent between 1975 and 1980.

More farm equipment is expected to become diesel-powered. Indeed, the diesel engine is 25 percent more efficient in fuel use than the gasoline engine because of its high thermal efficiency and capacity to finely meter fuel (Furniss 1978:24).

Heating oil used on farms in Alberta has declined by nearly 43 percent over the past five years because of the upswing in rural conversion to natural gas (Jensen Engineering Ltd. 1981:20). The latter is also used to a greater extent than propane for grain drying. Feed processing and irrigation pumping are being powered more and more by electricity rather than gasoline and diesel fuel (Jensen Engineering Ltd. 1981:35).

Because of government tax concessions and subsidies, the rising prices of direct energy inputs have not had as much of an impact on total farm costs as rising interest rates, machinery expenses, and land costs (Jensen Engineering Ltd. 1981:27). In addition, because the latter expenses are a larger proportion of total cost, even small percentage increases in cost may represent a large increase in actual outlay. The following provincial allowances for diesel fuel, gasoline, and heating oil used in primary agriculture have been implemented:

Diesel fuel: 1 May 1974 - 5 cents per gallon (1.10 cents per litre)
 Gasoline: 1 Sept. 1975 - 8 cents per gallon (1.76 cents per litre)
 Heating oil: 1 Apr. 1978 - 12 cents per gallon (2.64 cents per litre)
 (Jensen Engineering Ltd. 1981:17).

Higher energy prices will have a greater effect on the more intensive cropping systems since they employ a greater amount of energy input per unit of output. Substantial energy inputs are needed in swine and poultry operations to maintain the animals in heated barns and to process feed. Small operations are generally less intensive than large operations in terms of energy input per unit of output, with the exception of dairy farms (Jensen Engineering Ltd. 1981:29).

Table 26. Farm purchase of gasoline and diesel fuel in Alberta (millions of litres)

Fiscal Year	Marked Gasoline	Marked Diesel
1975-1976	533.7	268.2
1976-1977	542.3	292.8
1977-1978	562.8	319.1
1978-1979	535.0	324.6
1979-1980	508.2	345.7

Source: Adapted from Jensen Engineering Ltd. 1981:Table 3.1.

INDIRECT ENERGY INPUTS

The general increase in agricultural production since the early years of farming in Alberta can largely be attributed to the use of fertilizer. Because of differences in soil nutrient content and efficiency of nutrient uptake, fertilizer requirements are not uniform (Hinsh 1980:8). However, nitrogen is the most important limiting crop nutrient. Its manufacture requires approximately 35,000 cubic feet of natural gas to produce 1,600 pounds (Furniss 1978:18). Compared to nitrogen fertilizer, energy inputs for the production of the other two important nutrients, phosphorous and potassium, are relatively small. However, manufacture of phosphorous involves transportation of phosphate rock from Idaho, Montana, and Utah and thus represents a high demand for fuel (Jensen Engineering Ltd. 1981:22). In 1978, the consumption of 243,762 tons of nitrogen fertilizer was nearly equivalent to that of marked gasoline as an energy input. Phosphorus purchases in 1979 amounted to 134,003 tons, an 800 percent increase from the quantity consumed in 1958 (see Table 21). But a reduction in fertilizer use because of escalating energy prices paid for its manufacture could reduce soil fertility and lower yields.

In the past 30 years, pesticides (includes herbicides, fungicides, insecticides, etc.) have been increasingly used to control the proliferation of insects, weeds, undesirable plants, fungi, and rodents (Lang and Armour 1980:172). These products are formulated mainly from ethylene and benzene which are in turn produced in intermediate stages from natural gas or crude oil (Furniss 1978:21). The total energy input for the manufacture of pesticides is minor compared to that of fertilizer because of the relatively low application rate. Further increase in the use of pesticides, of which herbicides are the most important, will necessarily entail a greater dependence of the primary agricultural sector on fossil fuels.

Figure 5 shows the influence of higher petroleum product prices on the total farm input price index and, in particular, on the prices of fertilizers and pesticides. It is evident that fertilizer prices have varied more widely than petroleum or pesticide prices, but in each case, the price of petroleum products leads the direction of movement in price.

The energy input for manufacturing machinery will continue to add significantly to the cost of farm equipment. Exact measurement of the energy required to produce machinery is difficult since it must be amortized over the lifetime of the equipment (Jensen Engineering Ltd. 1981:25). Larger tractors are taking a greater share of the market thus increasing cost per acre upon acquisition. One consequence of the trend to larger tractors is that the average farm unit is expanding to spread the fixed costs over a large holding.

Figure 6 gives a breakdown of the proportions of various direct and indirect energy inputs consumed by Alberta farmers. Liquid fuels represent more than three-quarters of the direct energy used in agriculture and nitrogen fertilizer employs the most indirect energy.

ENERGY CONSERVATION

Energy consumption in the primary agricultural sector could be reduced by following basic conservation principles. For example, more than 50 percent of the gasoline consumed by farmers is used for motor vehicles (Jensen Engineering Ltd. 1981:39). Buying vehicles

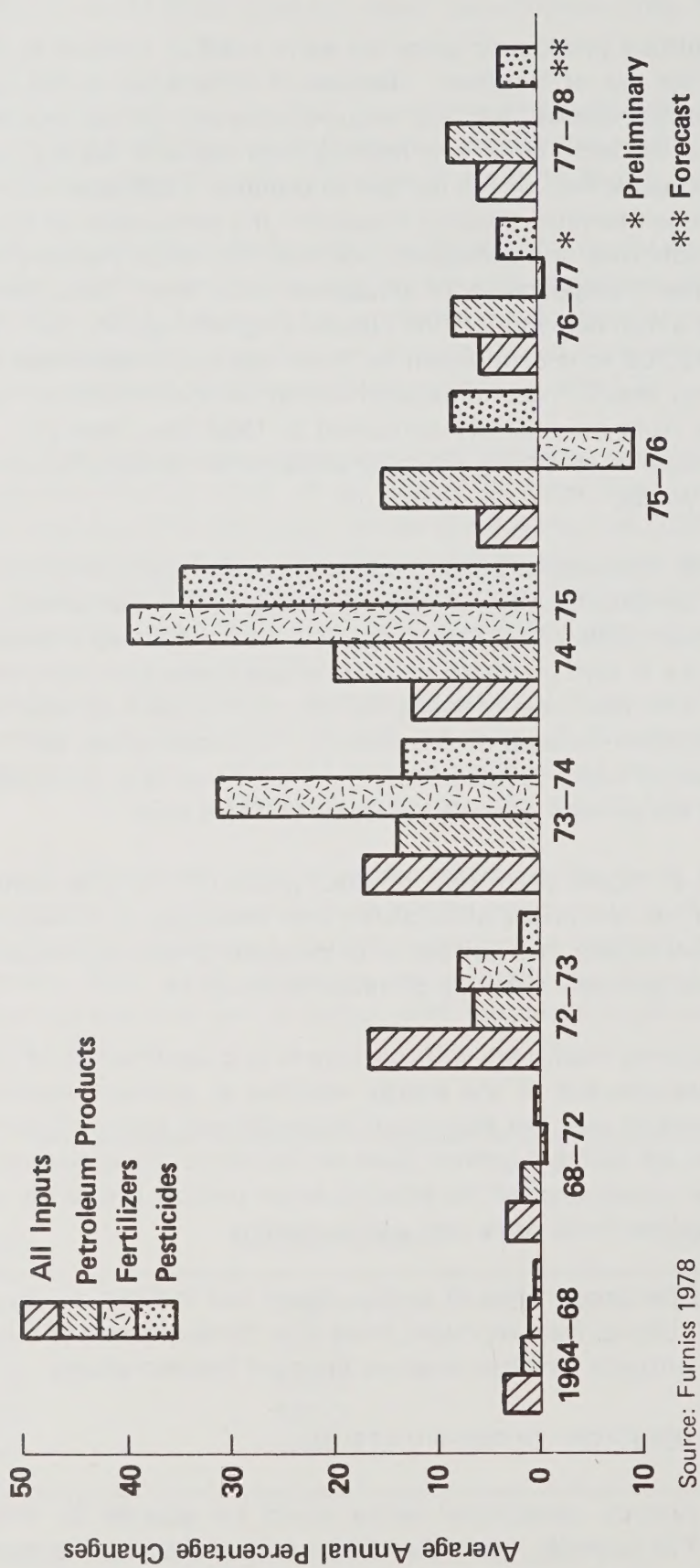
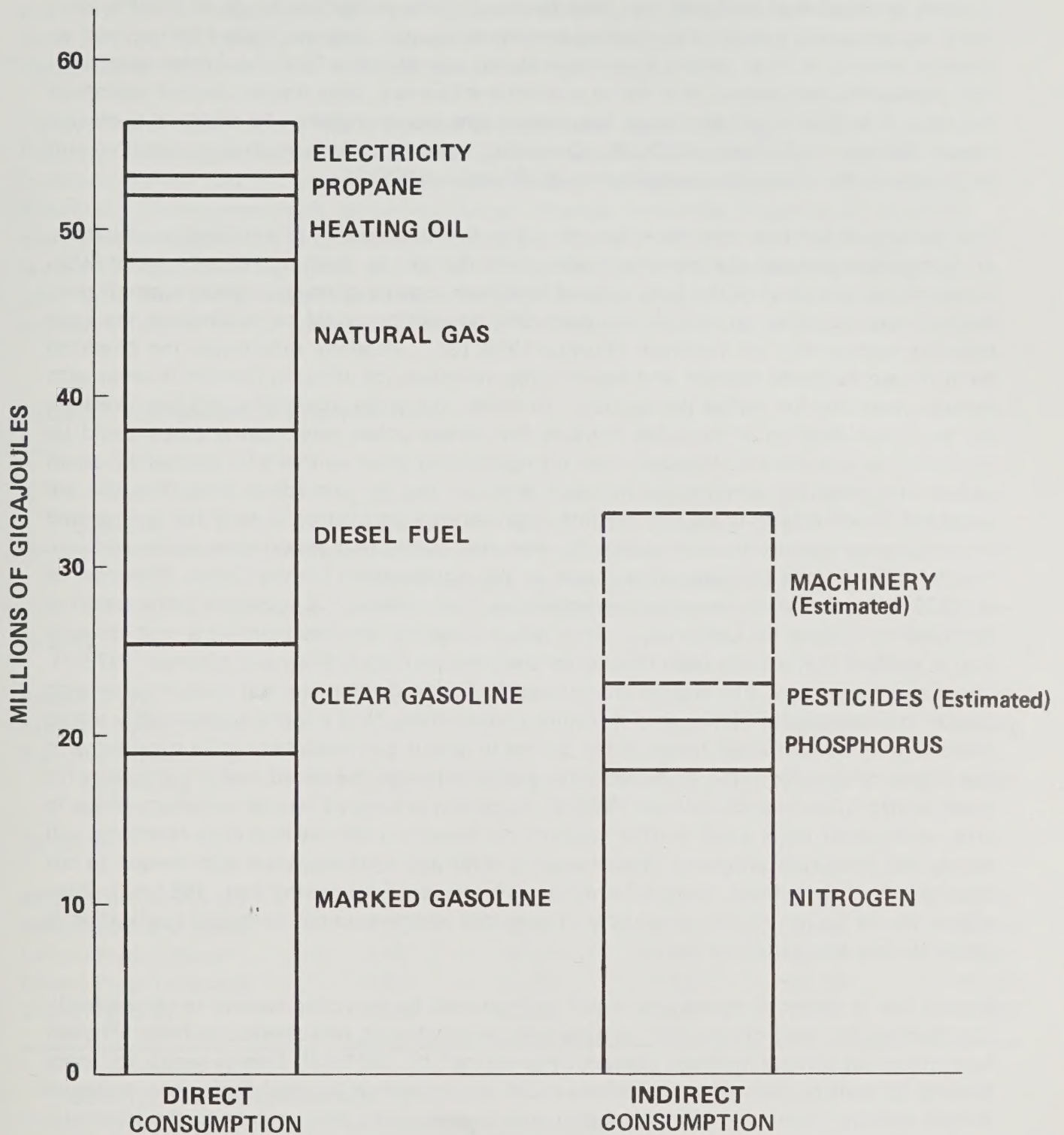


Figure 5. Average Annual Percentage Changes in Canadian Farm Price Indexes for All Farm Inputs and Energy-Related Farm Inputs



Source: Jensen Engineering 1981:Figure 3.1

Figure 6. Distribution of Energy Consumption by Alberta Farmers

with better fuel economy along with subsequent maintenance could save gasoline. A reduction in diesel fuel and gasoline used to power farm machinery is not as feasible since lower weight would not give the required amount of traction. Because of the high cost and increasing scarcity of farm labour, larger farm equipment will most likely be further integrated into production techniques. In order to maximize efficiency, large tractors should operate at the rated load power and not lower. Equipment size should therefore be matched to tractor power (Strayer and Zoerb 1980:20). Combined operations such as discing, seeding, and fertilizing could reduce labour and fuel costs (Manning 1975:26).

The quantity of fertilizer used could be reduced by the development of nitrification inhibitors, or agents that prevent the loss of nitrogen from the soil by leaching (Wittwer 1979:605). Since almost one-third of the final price of fertilizers consists of transportation expenditures, steps should be taken to reduce this cost. One possibility would be to diminish the inert material component of fertilizer (Furniss 1978:18). Possible substitutes for chemical fertilizer are livestock manure and legume crop rotations for nitrogen fixation in areas with enough moisture for forage production. However, the latter alternative requires livestock for feed consumption or available markets for forage unless new legume crops could be produced for the market. Research into nitrogen-fixing grain cultivars (if successful) could reduce the need for commercial nitrogen fertilizer but no immediate breakthroughs are expected. When rotations are not feasible, legumes may be planted in early fall and plowed under as green manure in early spring. D. Pimentel claims that green manure adds approximately 133 pounds of nitrogen per acre in the northeastern United States (Pimentel et al. 1973:447). Another new cropping technique, "zero tillage," is currently being tested at the research station in Lethbridge. Zero tillage cropping involves planting a crop directly into a seedbed that has not been tilled since the previous crop (Zenter and Lindwall 1978:1). The major benefits of this system are reduced fuel consumption and soil erosion along with greater nitrogen accumulation and moisture conservation. It is a more economically viable practice than conventional tillage if the savings in labour and machinery costs together with the higher returns from the increased crop yields outweigh the added cost of herbicides for weed control (Zenter and Lindwall 1978:4). Adoption at large of zero or minimum tillage in crop production must await further research on impacts under various crop rotations, soil types, and herbicide programs. Better seeding drills and equipment are also needed to cut through the heavy trash cover of untilled soil (Jensen Engineering Ltd. 1981:41). Zero tillage would be beneficial particularly in a system where required herbicide application is relatively low and yields are high.

Energy use in livestock operations could be improved by recycling manure to reduce fertilizer demand for feed production, cutting back on processing, and developing more efficient harvesting and storage methods (Jensen Engineering Ltd. 1981:41). Energy inputs for space heating in poultry and swine operations could be diminished by establishing the optimum animal density, improving barn insulation and lowering barn temperature to the minimum health safety level (Jensen Engineering Ltd. 1981:42).

The establishment of irrigation districts in southern Alberta, for 5300 farms encompassing over one million acres (Jensen Engineering Ltd. 1981:44), has increased energy output (that is, crop production) but not enough to offset the high energy input required for pumping water. Gravity delivery systems were originally used in southern Alberta, but as the cost of labour relative to energy rose, the more energy-intensive sprinkler systems were

installed. In Table 27, it can be seen that the labour cost of gravity flooding is much higher than that of the mechanized sprinkler system. However, the fixed costs for both systems (land levelling for gravity irrigation and equipment for pressurized irrigation (Jensen Engineering Ltd. 1981:45)) surpass both labour and energy input costs.

Today, more than half of the irrigation systems have substituted sprinklers for gravity flooding. Natural gas, diesel fuel, and electricity are used for pumping water. Yield per acre is approximately two and one-half times higher on an irrigated farm than on a dryland farm. Moreover, diverse crops such as cereals, forage, oilseeds, vegetables, sugar beets, potatoes, corn, peas, and beans can be grown on irrigated land (Jensen 1981:44). But the energy input is roughly eight times as high as that of an efficient dryland farm (Jensen Engineering Ltd. 1981:83). This energy input could be diminished by operating sprinkler systems at lower pressures. Higher energy costs will likely limit the extent of irrigation unless prices of the

Table 27. Comparison of irrigation costs

Systems	Labour Cost *	Natural Gas**	Other Variable Costs	Annual Fixed Cost†	Total Cost
\$ per acre (applying 10 inches of water)					
Gravity					
Border Dykes	6.85	-	1.00	41.30	49.15
Furrows (Gated Pipe)	6.40	-	2.00	67.50	75.90
Furrows (Gated Pipe) with Pump	7.10	1.75	2.50	75.25	86.60
Sprinkler					
Wheel Roll (4 laterals)	5.00	8.80	3.50	62.00	79.30
Wheel Roll (2 laterals)	7.50	9.40	2.50	40.00	59.40
Centre Pivot (fixed)	2.40	9.90	11.50	93.00	116.80
Centre Pivot (towable)	4.00	10.20	7.00	65.00	86.20
Travelling Gun	9.60	15.20	3.00	72.60	100.40

* Labour costs were based on \$8.00 per hour.

** Natural gas costs were based on \$2.50 per million cubic feet.

† A 15 percent interest rate was assumed.

Source: Ring 1982: Personal Communication.

variety of crops grown on irrigated land rise enough to make expansion economically feasible (Manning 1975:21).

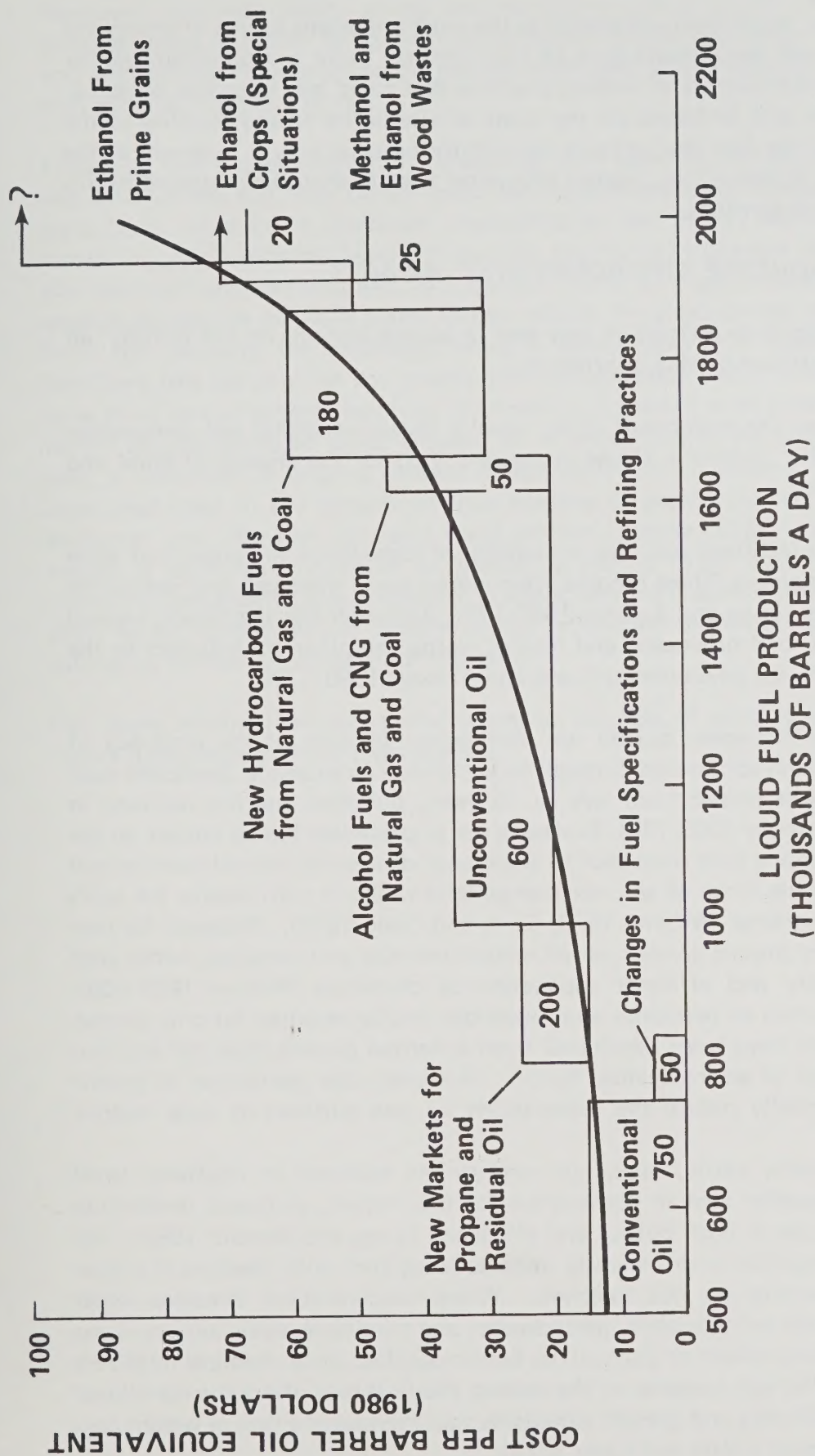
Many producers are forced to use dryers during wet harvest conditions and this practice is becoming more common in central and northern Alberta. Dryers are also used to extend harvest time by allowing the farmer to work earlier and to extend his activities later in the fall. The recent development of microwave dryers could substantially reduce overall costs and greatly increase the use of dryers across the prairies. Operating the grain dryer in early fall, or at warmer ambient temperature when possible, and natural air drying when the moisture content is relatively small could reduce consumption of propane and natural gas (Jensen Engineering Ltd. 1981:50). Research in plant breeding should be directed toward developing faster maturing grains to reduce the dependency on grain drying in areas with shorter growing seasons (Manning 1975:26-27).

Energy requirements of today's farming consist mainly of direct inputs: diesel fuel and gasoline for mobile equipment, electricity for stationary equipment, and natural gas for heating. In these areas as in other sectors of our society, opportunities to conserve energy abound. But making the most of the opportunities requires the farmer's co-operation (meaning his time and his labour), which he may be unable or unwilling to give without assurances of sufficient return. Also, adopting energy conservation practices may involve some initial capital investment to save energy in the long run. For example, diesel engines are beginning to substitute for gasoline engines in transportation vehicles (thus adding pressure on supply at present) but modification of the gasoline engine to propane would cost \$1,500 per unit (Jensen Engineering Ltd. 1981:52).

ENERGY SUBSTITUTION

Alternate fuels are not economical in the short term and future substitutions will depend on the price of conventional energy sources. A possible scenario of choices is shown in Figure 7. Fuel produced, for example, from the processes of coal gasification and coal liquification will be competitive with crude oil at \$45-\$60 a barrel. Production of grain alcohol or ethanol could provide a new market for the surplus of cereal grains although the cost of production is significantly higher than that of fossil fuels (Strayer and Zoerb 1980). The use of ethanol as a fuel could increase the threat of a food shortage and overall the opportunity cost, or the resources foregone in their best alternative use, is too high. Indeed, the price of oil would have to reach \$60 a barrel for the production of ethanol from grain to become economical. Wood alcohol is another possible substitute for hydrocarbons although methanol produced from abundant sources of natural gas is still cheaper. Vegetable oils such as rapeseed oil could possibly replace diesel fuel, if the latter approached a price of 50 cents a litre, although the greater viscosity of vegetable oils could cause problems (Jensen Engineering Ltd. 1981:57).

Fuel extenders such as gasohol (90 percent unleaded gasoline and 10 percent ethanol) and diesohol (90 percent diesel fuel and 10 percent alcohol) (Strayer and Zoerb 1980:18) are more feasible alternatives in the short run in terms of price. The latter is evidently more important because of the proliferation of diesel-powered tractors and equipment. But both of these forms of energy will only negligibly reduce the primary agricultural sector's reliance on fossil fuels.



Source: Jensen Engineering 1981:Figure 7.3

Figure 7. Alternate Energy Substitutions

In the foreseeable future, fossil fuels will prevail as the most important source of energy for agricultural production and the manufacture of farm inputs. There are opportunities for conservation and improved efficiency in farming practices that could help to reduce consumption. Energy substitution will be based on the costs of alternative energy supplies to the agricultural sector. Given the fact that primary agriculture takes up only 2.7 percent of the nation's domestic energy consumption, highest allocation priority should be assigned to this sector in the event of a fuel shortage.

ADVERSE ENVIRONMENTAL IMPACTS

Highly energy-intensive inputs to agriculture may lead to adverse impacts on soil fertility, air and water quality, and nutritional value of produce.

Heavy machinery, such as the moldboard plow, usually causes unnatural soil compaction (Geno and Geno 1976:31). Intensive tillage operations increase the chance of wind and water erosion of the topsoil.

If there is a runoff from fertilized soil, the probability of stimulating the growth of algae blooms in water bodies increases. These blooms often release toxic chemicals and reduce the number of aquatic species (Lang and Armour 1980:172). Although less significant, treated sewage, soil erosion, and food processing and feedlot wastes are other contributors to the excess release of nitrates to the environment (Lang and Armour 1980:172).

The effects of pesticides on water quality are detrimental because of the tendency of some pesticides to persist and accumulate through food chains. For example, pesticides such as chlorinated hydrocarbons persist from two to 15 years, but their use has declined in recent years (Lang and Armour 1980:174). Extensive use of pesticides has an impact on the soil environment by increasing pest resistance to chemicals, destroying natural enemies and pollinators, and reducing the range of soil micro-organisms which in turn lessens the soil's capacity to decompose nutrients (Wittwer 1979, Geno and Geno 1976). Research for pest control should be directed toward greater use of natural enemies and parasites, better seed varieties, and more timely and efficient application of chemicals (Wittwer 1979:605). Increasingly greater quantities of pesticides and fungicides may be required for crop protection since high-yield crops have been developed from a narrow genetic base and are thus vulnerable to a wide range of environmental factors. However, new techniques in genetic engineering could substantially reduce the vulnerability of new cultivars to these factors.

Feedlot production, whereby cattle, hogs, and poultry are enclosed in relatively small areas and sustained by quality feed in preparation for the market, surpasses production on pastures and open ranges in both output and efficiency (Lang and Armour 1980:174). However, there can be negative environmental impacts associated with feedlots if proper manure management practices are not followed. Waste concentration threatens water quality since runoff can contaminate lakes, groundwater, and municipal water sources (Lang and Armour 1980:174). The problem of disposal has been magnified since chemical fertilizers hold the competitive edge for soil nutrients on the market. Feedlots may affect the nutritional quality of food since antibiotics and growth stimulants that increase the rate of weight gain may surface in processed meat (Geno and Geno 1976).

Moreover, the high-quality grains used to induce animal weight gain reduce the base of primary foods available for human consumption (Geno and Geno 1976). Since both feed and animals are transported to the feedlot, often over great distances, energy input costs are high and may continue to rise.

Producing ever higher yields may be economically essential, but without returning adequate nutrients to the soil, one of the most serious environmental consequences of the present agricultural situation is produced. According to one study, half of the original organic matter in prairie soils has been lost over the past 50 years (Rennie 1978). Since over half of the essential nutrients required by crops are found in organic matter, further depletion of organic content in our soils could further reduce the productivity of our farmlands. Aside from the necessity for increasing inputs — hence costs — of essential nutrients through fertilizers (the use of which has gone up 800 percent since 1961), several additional problems arise from loss of organic material. Infiltration of rainfall is retarded, resulting in increased runoff causing increased water erosion, all of which reduce the productivity of the soil. As well, a reduction in organic content breaks down the structure of the soil, allowing it to crust and bake in dry conditions thus slowing or preventing germination, decreasing air exchange, and allowing increased wind erosion (Rennie 1978). Unless certain economic trends in agriculture diminish or reverse, a vicious circle may be established whereby economic conditions cause producers to adopt farming practices which decrease soil productivity which, in turn, would increase cost of production and thus create economic conditions calling for further exploitation of the land.

For more information about environmental impacts of agricultural inputs, see the ECA report *Agriculture and the Environment*.

FARM INCOME IN ALBERTA

FACTORS AFFECTING FARM INCOME

Calculations of income from farming operations are difficult at best. A tremendous variety of factors influence farm income and each of them varies not only annually, but during the course of each year. Compounding the problem is the diversity of agricultural production throughout the province. If there are 60,000 farms in Alberta, there are likely 60,000 different responses to each economic factor affecting income.

One of the more important factors affecting farm income is the variable price for the crop/livestock mix found on each farm — on-farm stocks of grain and livestock inventories vary throughout the year as do the prices received. Another important factor, the variable cost of inputs to agriculture, is discussed fully in Chapter 4. The amortized value of farm buildings, machinery, and land; indirect subsidies; and the annual cost of the infrastructure for agricultural transportation, marketing, and processing are extremely difficult to estimate. Estimates of operating expenses must be based on survey research with all the limitations this entails. Interest rates vary weekly, adding to the problem of cost calculations, particularly for short-term seasonal agricultural loans. Unlike ordinary wages and salaries, farm income calculations depend on a complex series of factors with few readily obtained data.

Despite the problems involved in farm income calculations, it is essential for governments continually to monitor and study the sector. Government programs designed to assist agricultural production must rely on the vast body of statistical information accumulated over the years and on continuing studies of agricultural income. This chapter will highlight some of the basic farm income information. Most of the income figures presented are province-wide totals or averages and may not reflect actual conditions on many farms.

ON-FARM INCOME

Values for 1980

The total value of all cash receipts from the sale of farm products in Alberta during 1980 was \$3.148 billion (see Table 28). Cash receipts for field crops were \$1.459 billion with 87 percent of the total received for wheat, canola (rapeseed), and barley sales. The livestock industry accounted for \$1.676 billion in cash receipts with cattle and calves bringing 71 percent of the total. Altogether, farm cash receipts rose by 11.5 percent over the 1979 total. The increase in cash receipts from field crop sales made up 77 percent of the increase over 1979 with livestock sales accounting for 19 percent and provincial stabilization payments and deficiency payments contributing 4 percent to the rise. Preliminary totals for 1981 indicate that gross farm income increased by 23 percent over the 1980 total to \$3.9 billion (Alberta Agriculture 1982a).

Cattle and calf sales were the leading component of all cash receipts with 38 percent of the total. Wheat sales were the second highest cash producer at 21 percent of all receipts. Following these two leading sources of farm cash receipts were canola and barley at 9.7 percent and 9.9 percent respectively.

It should be noted that tame hay and over half the estimated total value of barley production are not included in the cash receipts table. Total gross value of tame hay production was

Table 28. Cash receipts from the sale of farm products in Alberta

	1979		1980	
	\$'000	% of Total	\$'000	% of Total
Wheat	446,767	15.8	656,268	20.8
Oats	14,343	0.5	27,781	0.9
Barley	242,752	8.6	311,135	9.9
Western Grain Stabilization	59,600	2.1	-	-
Crop Insurance Payments	24,767	0.9	32,948	1.0
CWB Net Cash Advance Payments	- 10,431	- 0.4	1,732	0.1
Deferred Grain Receipts	- 5,593	- 0.4	- 64,961	- 2.0
Rye	12,545	0.4	30,485	1.0
Flaxseed	17,837	0.6	29,642	0.9
Canola/Rapeseed	314,652	11.1	304,535	9.7
Sugar Beets	21,163	0.7	44,821	1.4
Potatoes	13,976	0.5	14,918	0.5
Vegetables	10,192	0.4	12,622	0.4
Floriculture and Nursery	19,433	0.7	23,816	0.8
Other Crops	25,494	0.9	32,592	1.0
Forest and Maple Products	1,049	*	980	*
Total Crops	1,208,546	42.8	1,459,314	46.4
Cattle and Calves	1,181,282	41.8	1,197,793	38.0
Hogs	168,649	6.0	173,992	5.5
Sheep and Lambs	5,326	0.2	7,904	0.3
Dairy Products	137,956	4.9	163,894	5.2
Poultry Products	93,416	3.3	101,469	3.2
Other Livestock	27,609	1.0	32,251	1.0
Total Livestock and Products	1,614,238	57.2	1,676,303	53.2
Provincial Income Stabilization	-	-	-	-
Deficiency Payments	598	*	12,604	0.4
Total Cash Receipts	2,823,382	100.0	3,148,221	100.0

* Less than 0.05 percent.

Note:

Interim and final payments through the Canadian Wheat Board on participation certificates (wheat, oats, and barley) are included in the calendar year in which payments were received by farmers.

Source:

1. Alberta Agriculture 1981a:7 for 1979 data.
2. Alberta Agriculture 1982a for 1980 data.

estimated to be \$480 million during 1980, while total estimated barley production was estimated to be worth over \$800 million (Alberta Agriculture 1981a:5). The reason for their omission in calculating cash receipts is that these two crops are primarily feedgrains and are often stored on-farm for wintering livestock herds. Including these two products under cash receipts would amount to double counting since their value is presumably fed to the livestock for which cash receipts are already counted. Part of the difficulty in determining farm income stems from this potential for double counting as well as on-farm storage. No income from interfarm product sales within the province is included in these figures since net income is not affected. That is, the income received by the selling farmer is cancelled by the cost to the purchasing farmer.

During 1980, improved grain markets and transportation efficiency allowed Alberta producers to reduce grain stocks and sell nearly all the grain they wished. Stocks of wheat on farms were reduced by 50 percent, barley by 64 percent, and oats by 35 percent during 1980 (Alberta Agriculture 1981a:1, 35). Despite improved marketing of flax and canola, on-farm stocks increased somewhat for these crops. These annual fluctuations in stocks of grain on farms can substantially alter the cash receipt picture for Alberta producers. On-farm storage is costly to the producers and an efficient transportation and marketing system continues to be a critical factor in farm income stability (see Chapter 6).

With cash receipts of over \$3 billion, farm income sounds like a great deal of money and indeed amounted to an average of over \$50,000 per farm. However, a more important statistic is net farm income (gross income less operating costs and depreciation). Estimates of farm operating expenses are presented in Table 29. Using an estimate of 60,000 for number of census farms in Alberta, average operating expenses and depreciation charges per farm were over \$40,000 in 1980. Combining the data contained in Tables 29 and 30, the average farm in Alberta had a net income of \$13,257. Estimates for 1981 are that net farm income increased over 30 percent to about \$18,000 per farm (Alberta Agriculture 1982a).

Farm Capital

Cash income, income in kind, and increased value of inventory (from Table 33) do not entirely explain the financial position of farmers. There is also the matter of farm capital accumulation, a non-cash but readily available source of funds, either through sale of assets in whole or part, or through an enhanced ability to borrow against the equity. One study estimated that net farm worth, using different interest rates and life expectancies, accounted for between 50 and 60 percent of the "total economic well-being" of farmers during the period from 1967 to 1977 (Chase and Lerohl 1981).

The implications of this conclusion are immense, especially considering the rise in capital value of farms since 1977 (see Table 31). The cliché that farmers are land rich and cash poor is apparently an accurate description of fact. Capital accumulation has outstripped the *gross* income of Alberta farmers six of the last 10 years. Over the past 10 years, farm capital has increased in value by \$21.657 billion compared to a total net farm income of less than \$6 billion during the same period. During 1979 and 1980, the increase in farm capital value was 6.75 times the total net farm income (see Table 31). Rapidly increasing land and building prices are the major cause of this phenomenon, accounting for 83.8 percent of the increase (calculated from Alberta Agriculture 1981a:12).

Many businesses face what are known as "short-term cash flow problems." This means that a business may have assets worth many times the value of its debts and may also have money owed to it worth more than its debts, but due to a problem in timing it is forced to borrow additional funds to stay in business. If the business cannot obtain the necessary funds in time to meet its commitments, it may be forced to sell the assets and close despite its apparent wealth. Alberta farmers may be facing just such a situation.

Outstanding farm credit increased by over 300 percent during the 1970-79 period, increasing farm debt to \$2.77 billion in 1979 (see Table 32). However, this apparently huge rise in debt was more than compensated for by the rise in total value of farm assets (424 percent), leaving Alberta farmers with the lowest debt/equity ratio since 1960 (Anderson and Associates 1981, and Table 32). This reduction in the debt/equity ratio continued its downward trend in 1980 despite increasing interest rates and was lower in Alberta than in any other province at 10 percent (Farm Credit Corporation Canada 1981).

Table 29. Farm operating expenses and depreciation charges in Alberta

	1979	1980	% Change
	- thousand dollars -		
Taxes	31,109	35,109	+ 12.9
Gross Farm Rent	118,480	145,705	+ 23.0
Wages	105,486	127,551	+ 20.9
Interest	306,907	362,243	+ 18.0
Fuel and Lubricants	151,236	176,872	+ 17.0
Machinery Repairs and Expenses	177,825	217,929	+ 22.6
Fertilizer	179,205	202,906	+ 13.2
Other Crop Expenses	102,430	117,195	+ 14.4
Feed	168,458	196,652	+ 16.7
Other Livestock Expenses	178,574	166,957	- 6.5
Repairs to Buildings	37,522	39,180	+ 4.4
Electricity and Telephone	44,324	50,540	+ 14.0
Miscellaneous	116,597	142,612	+ 22.3
Total Operating Expenses	1,718,153	1,981,451	+ 15.3
Depreciation Building and Machinery	447,542	527,047	+ 17.8
Total Expenses	2,165,695	2,508,498	+ 15.8

Source:

1. Alberta Agriculture 1981a:9 for 1979 data.
2. Alberta Agriculture 1982a for 1980 data.

Despite the low debt/equity ratio and rapidly increasing land prices to this point, farm businesses have a surprisingly limited debt capacity because of the generally low and fluctuating nature of their cash flows (Farm Credit Corporation Canada 1981). If record interest rates are maintained and the steady rise in other input costs to agriculture continues unabated, and these conditions are combined with a drastic reduction in or even maintenance of present levels of gross income during the next few years (a very real possibility considering historic patterns), very serious consequences could result.

Farmers would then be in a position where they could afford to retire comfortably (by selling out) but could not afford to continue producing. Under these conditions, those leasing land or paying for their land on credit would be faced with the loss of their livelihood. This situation could lead to a rapid sellout of farm assets and the market for agricultural land, like all supply and demand markets, would react with an equally rapid reduction in the value of farm capital until such time as an equilibrium between the perceived productive value of farm assets and the expected return was reached. Under these circumstances and with no government supports, one could expect a consolidation and restructuring of agricultural landownership unseen since the early 20th century. Inflated agricultural land prices, which are not related to the productive value of the land (see Chapter 4), would fall to whatever level necessary to motivate those with investment capital to buy. Although this scenario would presumably be short-term, many farmers would probably not be able to survive more than a few years of real pressure because at the same time as their costs rise and their returns fall, their borrowing capacity would be reduced due to the high interest rates and falling value of their assets (caused by those selling their farms).

Table 30. Net income of farm operators from farming operations in Alberta

	1979	1980	% Change
	- thousand dollars -		
Cash Receipts from Sale of Farm Products	2,823,382	3,135,617	+ 11.0
Income in Kind	34,678	34,147	- 1.5
Realized Gross Income	2,858,060	3,182,368	+ 11.3
Value of Inventory Changes	79,701	121,556	+ 52.5
Gross Income	2,937,761	3,303,934	+ 12.5
Operating and Depreciation Charges	2,165,695	2,508,498	+ 15.8
Total Net Income	772,066	795,436	+ 3.0

Source:

1. Alberta Agriculture 1981a:8 for 1979 data.
2. Alberta Agriculture 1982a for 1980 data.

Table 31. Farm capital increase, gross income, operating expenses, and net farm income in Alberta, 1971-1980

	Annual Farm Capital Increase from Previous Year (million dollars)	Index	Annual Total Gross Disposable Income (million dollars)	Index	Annual Estimated Total Operating Expenses (million dollars)	Index	Annual Estimated Net Farm Income (million dollars)	Index
1971	206.46	100.0	809.66	100.0	483.07	100.0	326.59	100.0
1972	864.06	418.5	979.36	121.0	555.39	115.0	423.97	129.8
1973	1,482.73	718.2	1,441.68	178.1	692.74	143.4	748.94	229.3
1974	2,069.59	1,002.4	1,737.42	214.6	1,068.41	221.2	669.01	204.8
1975	2,091.09	1,012.8	1,999.52	247.0	1,254.80	259.8	744.72	228.0
1976	2,156.28	1,044.4	1,957.01	241.7	1,449.48	300.0	507.53	155.4
1977	667.31	323.1	1,896.90	234.3	1,522.47	315.2	374.43	114.6
1978	1,769.25	856.9	2,382.68	294.3	1,748.81	362.0	633.87	194.1
1979	5,723.50	2,772.2	2,937.76	362.8	2,165.70	448.3	772.06	236.4
1980	4,627.20	2,241.2	3,267.18	403.5	2,505.84	518.7	761.34	233.1
Totals	\$ 21,657.47		\$ 19,409.17		\$ 13,446.71		\$ 5,962.46	

Sources:

1. Anderson and Associates 1981:44, for Gross Disposable Income 1971-1973 and Operating Expenses 1971-1973
2. Alberta Agriculture 1981a:12, for Farm Capital, p. 8 for Gross Income 1979-80, p. 9 for Operating Expenses 1979-1980
3. Alberta Treasury 1980:115, for Gross Disposable Income 1974-1978, p. 116 for Operating Expenses 1974-1979

It is sobering indeed to consider that the only factor missing in this equation for disaster is a serious reduction in gross farm income. Given the instability of an international market wherein "some 80 percent of the deviations from trend in world wheat imports since 1963 are explained by U.S.S.R. imports" (OECD 1980:26), a few bumper crops in the Soviet Union combined with poor crops on the Canadian prairies could result in just such a reduction in incomes. Of course, climatic conditions alone could cause reduced incomes as they have so often in the past. The present economic structure of agriculture in Alberta appears solid, with a strong asset base and relatively good markets. However, agricultural production is operating with a thin line between profit and loss. Rising land prices, escalating input costs, and high interest rates require higher prices for agriculture products and greater yields to keep pace. If producers are unable to increase yields or obtain higher prices due to factors largely outside their control (international grain markets, climatic conditions, insufficient research funding, transnational inflation, and interest rates, etc.), they will be forced to change the face of agriculture in Alberta or leave the farm. One apparent change in the agricultural sector is already occurring. Off-farm income is rising.

Table 32. Outstanding farm credit, total value of farm assets, and debt/equity ratios, Alberta, 1971-79

Year	Outstanding Farm Credit	Value of Farm Assets	Percent
(million dollars)			
1970	896.57	5199.80	17.24
1971	958.22	5201.60	18.24
1972	978.43	6065.60	16.13
1973	1131.69	7548.30	14.99
1974	1410.54	9617.90	14.67
1975	1654.59	11309.00	14.13
1976	1901.19	13865.30	13.71
1977	2125.05	14532.60	14.62
1978	2434.08	16301.90	14.93
1979	2768.52*	22025.40	12.57

*Estimates based upon the average of the annual rates of change between 1975 and 1978.

Sources: Anderson and Associates 1981:41; Farm Asset Value updated for 1979.

OFF-FARM INCOME

Income received from sources other than the farming operation is an important component of total farm income. During 1976, 22.4 percent of total net income to census farmers came from non-farm sources. As can be seen in Table 33, the percentage of income received from off-farm work has varied somewhat over the years but clearly is rising in both amount and importance (Jensen 1978).

During 1976, nearly one-third of the census farms in Alberta reported off-farm work with a total value of nearly \$150 million. Of the 18,838 census farms reporting off-farm income, over 54 percent reported more than 157 days of off-farm work and 32 percent reported over 229 days work off the farm. The amount of off-farm work varied considerably across the province, but averaged 162.4 days for those farms reporting. The highest concentrations of off-farm work were reported in those census divisions nearest population centres and those in the foothills. C.D. 11 surrounding Edmonton ranked first with an average of 187.3 days worked off-farm for farms reporting such income. C.D. 6 surrounding Calgary was second, followed by C.D. 9 in the foothills west of Calgary. The census divisions with the fourth through sixth highest average number of days worked off farm were those surrounding Red Deer, west of Edmonton and centred on Lethbridge (Anderson and Associates 1981:143).

Average income received for off-farm work for those farms reporting such income was \$7,773 in 1976. Averaged over all census farms, off-farm income amounted to about \$2,400 per farm. Average on-farm net income per census farm was \$8,302 in 1976. From these calculations it can be seen that work off the farm can provide a substantial boost to total farm income. The *average* farm reporting off-farm income includes many farms with less

Table 33. Net disposable farm income from farming and off-farm income

Year	Net Disposable Income From Farming	Off-Farm Income	Estimated Total Income	Percent Off-Farm
(thousands of dollars)				
1956	272,000	27,502	299,502	9.2
1961	239,600	41,171	280,771	14.7
1966	434,240	55,380	489,620	11.3
1971	326,590	89,246	415,836	21.5
1976	507,531	146,422	653,953	22.4

Source:

1. Anderson and Associates 1981:44 for Net Income 1956-1971, Off-Farm Income 1956-1976
2. Alberta Treasury 1980:115 for Net Income 1976

than 127 days worked (40 percent), yet average off-farm income for those reporting amounted to 93.6 percent as much revenue as the average on-farm net income for all census farms. It should be noted that off-farm work is more common for farmers with small parcels of land (Foster Research - SRI International 1980: Vol. III). Off-farm income for these farmers probably contributes a major portion of the total income received.

The apparent difference between off-farm income and on-farm net income is reflected in average farm wages versus average industrial wages (see Table 34). Farm wages average only half of industrial wages and the latter must surely look appealing to farmers with skills required by industry. However, there are some pitfalls in using a direct comparison since expenses are deducted from net farm income while they are not for off-farm wages. Travel expenses may be significant for some farm residents travelling to work in neighbouring communities or cities. Some rural people may decide to take up residence in urban areas during the off-season, thus adding to their expenses. Working spouses of full-time farmers may account for a sizeable proportion of total off-farm income, which would enhance overall farming operations rather than detracting from farm labour, but would also add to total per farm expenses.

One of the major reasons for the rise in off-farm work may be an increase in part-time and hobby farms near urban centres. Country residents have been provided with an incentive to acquire enough land to maintain a certain level of agricultural activity in order to qualify for reduced tax assessments. Land qualifying for farmland status has a lower assessment than non-farm land as do farm buildings (Thompson 1981b).

Table 34. Comparison of industrial and farm wages in Alberta

Year	Average Farm Wages Per Day (Including Board)	Average Industrial Wages Per Day	Ratio
1970	10.60	26.16	.41
1971	11.50	28.19	.41
1972	12.25	30.56	.40
1973	13.50	32.53	.42
1974	17.10	36.59	.47
1975	20.16	42.29	.48
1976	24.27	47.89	.51
1977	26.72	53.48	.50
1978	27.50	55.44	.50
1979	31.79	62.86	.51

Source: Anderson and Associates 1981:52.

The existence of such a trend will become more clear with publication of the 1981 census statistics, but present data do indicate a rise in off-farm income near urban areas. There are additional implications in a rise in part-time or hobby farms. First, the part-time farmer may not be utilizing the land to the fullest extent due to time constraints caused by off-farm work. Second, on-farm income statistics accumulated for all census farms may be reduced to the extent that for an increasing number of farms, farm production is not the primary income source of the residents. Third, the price of agricultural land could be substantially increased due to an ability of a large number of small holders to outbid a single potential buyer of an economically viable farming operation requiring hundreds of acres. In addition, a large number of small part-time farms reduces the overall amount of agricultural land available to full-time farmers, adding to the cost of acquiring additional land (see Chapter 2).

There is a highly positive side to off-farm income. Farmers with marginal operations may be able to obtain enough capital from off-farm sources to improve the efficiency of the farming unit thereby decreasing the necessity for off-farm work. The availability of off-farm work may save many low-income farms during periods of slack product prices, increasing input costs, or crop failure. Farmers without livestock and with skills needed by industry may be able to solve their cash-flow problems by working in urban centres for five or six months. This would enable them to maintain their land holdings which have been accumulating capital value at a much higher rate than actual farm income has been rising (see Table 31).

It appears that some combination of factors is influencing farm residents to undertake an increasing amount of off-farm work. The proximity to major urban centres allows the opportunity for such work. The high wage rates for industrial labour relative to farm employment may provide some motivation for obtaining off-farm work. The present cash flow problems facing many farming operations may force farmers to seek outside employment. Farmers and their spouses are better educated and skilled in areas required by industry more than ever before. Many census farms may be that in name only, with off-farm work providing the bulk of income received, while on-farm income is viewed as supplementary (as in hobby and part-time farms). Whatever the reasons for increasing off-farm incomes, the trend will probably continue upward in the near future.

URBANIZATION AND FARM INCOME

Urbanization and industrialization in Alberta have been both a blessing and a curse to the farming community. They have provided ready access to off-farm work for many farmers and their wives, with the welcome addition of cash income not dependent on farm operations. At the same time, urbanization and industrial growth have resulted in a spillover of urban-based land values into the farm land base. The value of farm assets increased by 483 percent between 1971 and 1980, at a rate similar to total operating expenses (419 percent), and of course was a major contributor to rising operating expenses. At the same time, net farm income increased by only 133 percent.

The increased value of farm assets, if they had been influenced only by the ability to obtain increased farming incomes, should have roughly tracked the rise in farm net incomes. They did not do so because of the spillover from urban and economic growth. Built into the capital value of farmland is the potential for future use for non-farm purposes, such as country residences or industrial sites, and the value ascribed to the farm as a site from which

it is possible to access off-farm work. In addition are increases in farm values generated by those farmers close to developing centres who sold their land before they were ready to retire from farming. With the cash from those sales they bought alternative farmsteads, often far from any urban centre, and thereby transferred some portion of urban values to distant farming areas. The result is that few farming areas in Alberta have escaped having some urban, non-farm values built into their land price structure.

The results of this spillover are pleasant if the wish is to retire from farming and capture the reward of years of hard work and low income. It is also desirable to have a rapidly appreciating asset to provide security for borrowing. However, penalties arise when farms are being transferred between generations, and the beginning farmer is asked to cover land costs that have little relationship to the ability of the property to produce income. The other potential penalty, though it is at present only a potential, is instability of existing land values. The present levels are dependent on a demand that is partly generated from the urban sector — for small holdings, for industrial sites, for resource development, or for speculation. The supply has been limited because farming has generally remained viable during the past decade — farm receipts have outpaced farm expenses, and there has been little pressure for forced liquidation. However, major changes in markets, recurrent poor harvests, or even the long continuation of high interest rates could force large numbers of farms onto the market with a substantial stripping of asset values until a new equilibrium is reached.

Alternatively, if there was any reduction in the rate of urban and industrial growth in Alberta, the demand for farmland would be reduced, and agricultural land values would tend to level off or fall to the point where the future agricultural income streams that they can generate would become the principal basis for agricultural land values.

Neither of these scenarios seem likely, but they are possible. They represent an important element of potential instability, generated not by the farming community and its economic prospects, but by the impact of urban and industrial growth on the agricultural land base.

SUMMARY

Net income to farmers for living expenses has been quite low relative to non-farm sectors. At the same time, capital assets on the farm have increased very rapidly. Many farmers must borrow an ever greater amount each year to get the crop planted, carrying the debt until harvest and sales enable repayment. Record high interest rates charged on farm credit could place many farmers in a position of nearly constant cash flow problems. If these conditions persist, some farms may be forced out of the industry. If this occurs, the trend toward agribusiness and farm consolidation into much larger units may accelerate as land values remain constant or decrease. Agricultural land would then be in the hands of a very small land-owning group (see Chapter 2), with economic powers far beyond their number. Food production is of fundamental importance to any society, and tough decisions about the type of agricultural production Canadians desire will soon be upon us.

GRAIN HANDLING AND TRANSPORTATION

REVIEW OF THE DREGS CASE

The Dregs case is a landmark case in the history of the grain trade. It arose from a dispute between the Dregs and the Grain Elevator Company (GEC) over the handling and transportation of grain. The Dregs, who were grain merchants, claimed that the GEC had failed to properly handle and transport their grain, resulting in damage and loss. The GEC, on the other hand, claimed that the Dregs had not properly stored and handled their grain, and that the damage and loss were the result of the Dregs' negligence. The case was heard by the Supreme Court, which ultimately ruled in favor of the Dregs, finding that the GEC had failed to properly handle and transport the grain, and that the Dregs were entitled to compensation for the damage and loss.

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It is difficult to overstate the significance of physical geography in the development of Canada as a continental nation. Problems in transporting both people and materials have not diminished in relative importance from presettlement days to the present time. One has only to consider the controversies over northern pipeline developments, rail line abandonments (for both freight and passengers), gasoline price hikes, trucking, airline regulations, and statutory rail freight rates for grain to realize that transport issues are as important to our lives as they were to early settlers. Our very lives depend upon food and fuel transportation and our livelihoods depend on the efficient movement of goods and services into and out of Alberta.

HISTORY OF THE CROW RATE

One of the most significant factors in the development of agriculture in Alberta and on the prairies generally was the Crow's Nest Pass Agreement between the Canadian Pacific Railway (CPR) and the federal government in 1897. Under the conditions of this agreement, the CPR agreed to establish an upper limit on eastbound rates at 3 cents per hundredweight (cwt) below the 1897 rate for all grain and flour. This rate was finalized in 1899. In exchange for this and several other considerations, the federal government subsidized the building of a railway connection through the Crow's Nest Pass into the southern B.C. coal and mineral district from Lethbridge, connecting to the transcontinental railway system (Nagy et al. 1979).

Rapid expansion of the CPR during the last years of the 19th century and the first few years of the 20th century raised the concern that operation of a prairie railway should not be the sole right of one company. The Canadian National Railway (CNR) was established in 1919 from an amalgamation of several railway companies, creating a second transcontinental railroad. The Crow rate was also applied to CNR shipments of grain and flour (Alberta Agriculture 1980). The rates on grain and flour stayed below the Crow limit until 1918 when they were moved above this level under the War Measures Act. The Crow rate was not reintroduced until 1922 when Parliament lowered the rates in response to very low grain prices and high freight rates. The railways responded to this action by applying the rates only to the 289 shipping points in existence in 1897 rather than the 1600 shipping points operating in 1922. The railways then won this right in a Supreme Court decision. In 1925, Parliament legislated the Crow's Nest Pass rate effective for all shipping points on the prairies for grain and flour only. All westbound freight rates and the rate for other commodities moving east from the prairies were placed under the jurisdiction of the Board of Railway Commissioners (Hall 1977). This action effectively established the statutory nature of the Crow rate, which has remained in effect to the present.

The Crow rate was extended to grain shipped for export to the west coast in 1927 and to the port of Churchill in 1931. Branch line shipping points were included under the legislation in 1927 and numerous other grains and grain products have been encompassed by the statutory rates since that time (see Table 35). During the 83 years since the Crow's Nest Pass Agreement, the 1899 freight rate schedule has been expanded from covering grain and flour carried by one railway from a small number of shipping points on the prairies to a single eastern port, into covering a tremendous volume of various types of grain and grain products to five ports by three railways (CNR, CPR, and the Northern Alberta Railway) (Alberta Agriculture 1980).

Table 35. Grains, oilseeds and other products that qualify for statutory freight rates from western Canada

Grain, Flaxseed, Rapeseed Rates Apply on:

COMMODITY	COMMODITY
Barley	Spelt
Buckwheat	Wheat
Corn*	Hulls, Sunflower Seed, Ground*
Flaxseed	Linseed Meal*
Oats	Linseed Oil Cake*
Barley Cleanings	Linseed Oil Cake Meal*
Barley Meal*	Malt (made from grain only)
Beet Pulp, Dried, Sweetened or not Sweetened*	Millfeed
Bran	Oathulls
Breakfast Foods or Cereals (uncooked)	Oatmeal
Brewer's Dried Grain*	Pearl Barley
Chopped Feed	Pot Barley
Corn, Cracked*	Rapeseed Oil Cake*
Corn Meal*	Rapeseed Oil Cake Meal*
Crushed Barley	Rapeseed Screenings*
Crushed Oats*	Rolled Oats
Distillers' Dried Grain*	Rolled Wheat
Feed Grain, in sacks	Rye Meal
Feed, Animal and/or Poultry*	Shorts
Flaxseed Screenings	Soya Bean Meal*
Flour (made from grain or malt only)	Sprouts, Barley
Grits	Sunflower Seed Oil Cake*
Groats	Sunflower Seed Oil Cake Meal*
Rapeseed	Sweepings and Screenings
Rye	Weed Seed Oil Cake*
Seed Grain, in Sacks*	Weed Seed Oil Cake Meal*
	Wheat Germ*
	Wheat Meal

* All items with an asterisk do not qualify for statutory rate to west coast.

Source: Alberta Agriculture 1980:21.

As the variety of grains, oilseeds, and other agricultural products produced on the prairies expanded, certain inconsistencies in the incremental extension of the Crow rate developed. Some agricultural products were not included in the rate structure while similar commodities were allowed the original 1899 freight rates. In addition, products included in the list destined for Thunder Bay terminals are also eligible for the reduced rate if consumed in the domestic (Canadian) market, while those shipped to west coast terminals are not. A further inconsistency is maintained in that some commodities are eligible for the statutory rate if destined for eastern export terminals, but are excluded from eligibility for the rates if shipped to west coast terminals. These inconsistencies have had a substantial negative effect on certain prairie industries (Alberta Agriculture 1980).

THE DEVELOPMENT OF THE CANADIAN WHEAT BOARD

The rapid expansion of grain production on the prairies led to an equally rapid development of grain warehouses and then more efficient elevators along the rail lines. Primary grain storage capacity increased 10-fold during the first 20 years of this century (Hall 1977). However, the development of elevators led to a refusal by the railways to accept deliveries of grain from individual producers or from warehouses storing grain in less efficient bags. Thus, farmers were forced to sell grain to private grain handling and elevator companies. A Royal Commission was established to investigate producer complaints and this led to the Manitoba Grain Act of 1900 which applied to the prairie region. This Act forced the railways to accept deliveries from warehouses and, as amended in 1902, to allow individual producer car deliveries for bulk grain. These producer car deliveries are still permitted today and are becoming increasingly popular as the transport system deteriorates (Hall 1977).

A few privately owned grain marketing companies soon controlled most of the elevators along the railway lines, which led to producer dissatisfaction with the grain handling system. Farmers responded to the strong market position of the private elevator companies by forming competing producer organizations beginning with the Grain Growers Grain Company in 1906. Major complaints from the producers had to do with great fluctuations in price depending on the location of the producer and the company buying the grain, as well as problems of seasonal oversupply during harvest leading to depressed prices at precisely the time farmers must sell their grain (Alberta Agriculture 1980).

During World War I, the Board of Grain Supervisors was appointed to centralize the buying of wheat and suspended open market trading. At the end of the war, futures trading was re-established for a short time, but the Canadian Wheat Board (CWB) was instituted to market the 1919-20 crop to centralized buyers in the war-ravaged countries. At the end of this crop year, the open market was again established but prices declined rapidly as supply expanded relative to world demand. This drop in prices was associated with open market trading rather than declining demand as agriculture expanded overseas, and led to the development of several co-operative marketing pools.

The pools serving the three prairie provinces formed the Canadian Cooperative Wheat Producers Limited, to market their wheat. During the early thirties international demand diminished to such an extent that selling prices were lower than the initial prices paid to producers by the co-operative marketing agency. In addition to financial support from both the provincial and federal governments, the federal government assumed the financial

burdens of storing and selling the surplus wheat. Unsold wheat in storage rose from 76 million bushels in 1931 to 214 million in 1935 (Alberta Agriculture 1980).

The Canadian Wheat Board was re-established on 5 July 1935 to provide producers with a floor price for wheat, to pool market prices and equalize producer risk during each crop year, and to dispose of the enormous supply of unsold wheat. The CWB supported producer prices during the 1935-36 crop year, but during the next three years export prices were above the Board-established floor.

The beginning of World War II insured the continuation of the CWB, as centralized marketing abroad was deemed essential to the war effort. Stocks of grain accumulated early in the war and temporary storage for 113 million bushels was constructed while quotas were established for the first time in order to limit producer marketings. The early stages of the war disrupted trade patterns, but this situation soon changed to one of high demand, especially for red meat.

The CWB also assumed responsibility for grain transportation during the middle years of the war to assure orderly delivery to port terminals as demand increased. Heavy demand for livestock production during the war resulted in the shift of control over oats and barley to the Board as well as the implementation of a feed freight assistance policy to increase livestock production in eastern Canada. Fear of oversupply and a sharp drop in price after the war similar to the post-World War I period resulted in a continuation of the CWB (Haack et al. 1981).

During the early 1950s oversupply became a serious problem and in 1956, legislation was passed to subsidize storage of all wheat in excess of 178 million bushels. This was in effect an incentive to store grain and resulted in inefficiencies in the grain storage and handling markets. The subsidized storage filled elevators throughout the prairies and inconsistencies in grain car allocation made producer deliveries impossible in some areas.

The Bracken Inquiry (1958) was initiated to examine the problems of grain car allocations. The result was a distribution of grain cars based on the moving average receipts of each elevator company for six types of grain over the preceeding 12 months.

During the 1960s increased international demand and higher prices eliminated the surplus stock problems of the fifties. In 1965, the Senior Grain Transportation Committee was established to review the grain handling and transportation situation given the fact that centralized overseas buyers were interested in long-term contracts involving particular types and grades of grain. This type of selective demand required better organization of producer deliveries and better shipment scheduling. However, the importance of statutory freight rates and the antiquated elevator systems remained unexamined.

As a result of the Committee's work, and that of other groups studying the problem, a revised transport system was put into effect in 1969. The block shipping system redefined the conflicting geographical divisions used by the CWB, the railways, and the elevator companies into a series of commonly defined geographic blocks. Allocation of weekly orders according to stocks on hand and the distribution of railway cars among and within

commonly defined blocks improved the co-ordination of grade- and type-specific orders for grain with the number and type of cars required for movement to terminals.

It had become clear by this time that the grain handling and transportation system was changing from a storage-oriented system to a rapid throughput system designed to move grain to assured markets. The Boden Committee was appointed in 1970 to examine the problems arising from the developing throughput system. This committee revised the purpose of quotas from one of equity in pooling prices regardless of delivery time in the crop year, to one of insuring the availability of the grade, type, and quantity of grain necessary to meet overseas market commitments. Quotas were established on the basis of blocks rather than delivery points and quotas could be applied to both type and grade of grain.

Domestic feed grains were removed from CWB control during 1974. In 1976, a pricing formula for western feed grains shipped to eastern feeders was established based on United States corn competitive prices (the corn competitive price is derived by a formula including corn and soybean prices in the United States market as well as the nutritive efficiency of barley relative to other feed grains). In addition, feed freight assistance subsidies were reduced or eliminated for feeders in B.C., Ontario, and western Quebec. The funds formerly used for the feed freight assistance program were then allocated to developing feed grain storage facilities in these three provinces (Haack et al. 1981). As export demand and prices increased during the late 1970s, quotas on non-board feed grains were established in 1979 due to the inability of the grain handling and transportation system to keep up with export market requirements (Alberta Agriculture 1980).

RECENT FEDERAL INQUIRIES INTO THE RAILWAY RATE SCHEDULE

The MacPherson Royal Commission in 1961 examined the costs to the CNR and the CPR for transporting grain under the conditions of the 1899 statutory freight rates. The Commission concluded that revenue from transporting grain in 1958 was \$11 million less than the actual costs incurred by the CPR, and \$11.3 million below cost for the CNR (Alberta Agriculture 1980). The Commission recommended that the railroads be compensated for the shortfall on an annual basis, but that the statutory rates be retained for the benefit of the grain producers and the Canadian economy as a whole. During the debate on the National Transportation Act in 1967, a revision to the Act providing for a federal subsidy to the railways was deleted from the legislation partially due to scepticism regarding the MacPherson Commission's estimates of revenue shortfalls (Hall 1977).

In 1975 the Snively Commission of Inquiry was charged with conducting an investigation into railway allegations of excessive cost to move grain under the 1899 freight rates. This commission found that revenue shortfall to the railways was \$105.4 million in 1974 with no branch line abandonment or \$94 million assuming abandonment of 2,473 miles of prairie branch lines in accordance with the Hall Commission recommendations (see below). The Snively Commission's estimate for 1977 was a \$175.6 million loss to the railways; this estimate amounted to a shortfall in variable costs of over three times the revenue received for grain shipments at the statutory rates (Snively 1976).

The Grain Handling and Transportation Commission was appointed in 1975 to investigate the railway systems, including branch line routes and all aspects of the grain handling system. Chief Justice Hall (1977) recommended that the railway companies be compensated for losses incurred in transporting grain at the statutory rates. The Commission recommended that the government compensate railways directly rather than paying producers according to the volume of their deliveries.

Among the many questions addressed by the Commission was the hidden costs of marketing grain, which work to inhibit innovative, more cost-efficient marketing techniques. Concern was expressed that grain handling, transportation, and marketing costs remain unexamined compared to the extensively studied direct costs of production. As a result, there have been tremendous technological advances in production techniques while the marketing system, including transportation, has stagnated with only incremental changes to superficial structures and procedures (Hall 1977).

Another significant factor in the freight rate structure is the transportation of uncleaned grain to the export terminals. The screenings separated from the grain when cleaned at terminal elevators have a substantial value yet the producer is not paid for this 2.5 percent of the total grain delivered. Shipping screenings represents a loss of relatively cheap feed for prairie livestock producers, a windfall gain for the grain companies, and additional cost to the railways and government for shipment. The Commission pointed out that the capacity for cleaning grain on the prairies already exists and that under utilization of this capacity adds still another inefficiency to the grain handling and transportation system (Hall 1977).

The Commission also described several CWB policies which discriminate against the flour milling industry in western Canada and favour flour mills in the east. Diversion charges levied only on the west, producer subsidization for the extra storage capacity required for eastern mills, CWB transport service costs applied to western mills despite the fact that they do not receive the services, and a differential subsidization of stopoff charges favouring eastern mills by 7.5 cents per hundredweight were described as discriminatory. The Commission recommended that all distortions of natural geographic advantages incurred by location be eliminated from the grain handling and transport system. These recommendations were applied to rapeseed oil and meal as well as livestock, meat, and the malting industry (Hall 1977).

THE COST OF HANDLING AND TRANSPORTING GRAIN

The costs involved in the present grain handling and transportation system have been the subject of many recent studies. Various research papers, publications, and government inquiries have examined all aspects of the system including numerous spin-off costs and benefits resulting from alleged economic inefficiencies and distortions. Partially because of the conflicting economic interests involved, the differing social philosophies at stake, and the diverse and complex analytic approaches taken, no consensus of opinion has emerged.

Certain facts have been established. The grain handling and transportation system is not adequate for shipping present or projected future volumes of agricultural products to their destinations. The railway companies are not receiving enough direct income from grain transportation to warrant further capital expenditures for improving the system. Any

proposed change to the present Crow rate structure will be embroiled in political as well as economic disputes. It seems clear that the various groups involved with the issue, however conflicting their positions may be, are sincere in their positions and can present cogent arguments to support their respective cases.

COST TO THE RAILWAYS

The difference between the costs to the railways for moving a bushel of prairie grain and the statutory Crow rate — often called the Crow gap — has steadily increased. In addition, the volume of grain transported under the 1899 rate has increased drastically, multiplying the financial losses to the railways for hauling grain. As the losses for transporting grain rose, the willingness of the railways to invest in improvements to the system diminished.

One study published in 1975 calculated that the railways received about 10 percent of their revenue from shipping grain while nearly 30 percent of the total freight carried consisted of grain and grain products. The same study pointed out that the return to Canadian railways was less than one-third that of United States railroads carrying grain similar distances (Kulshreshtha 1975).

Another study calculated the difference between the rates for hauling grain similar distances in the United States and Canada to be a ratio of between 3.5:1 and 4.9:1. Assuming normal profits and similar real costs in the United States rail system compared to Canada, this would indicate a fixed and variable cost shortfall for Canadian railways of over four times the statutory rate (Tosterud 1977).

The Snively Commission and follow-up study found that less than one-third of the variable costs of the railways were covered by the statutory rates in 1977 (Snively 1976; Snively, King, and Associates 1978). It should be emphasized that only the variable costs were included in this study. This means that even if the railways were compensated at three times the Crow rate in 1977, the railways would still not be covering depreciation on their fixed investment and would have no incentive to upgrade rolling stock or locomotive capacity, or to improve railbeds.

Some of the fixed costs to railways for grain transportation have been shouldered by the federal government since 1970. These are the subsidies paid, based on railway claims, for branch lines serving prairie farmers. In addition, expenditures in the form of repairing and purchasing grain cars have been made to maintain a viable grain transportation system (see Table 36 for federal expenditures from 1970 to 1979).

A study done by Booz, Allen and Hamilton (1979) concluded that the statutory rates would have to be increased by five times *and* the total volume transported would have to increase by 30 percent before the railways would have sufficient incentive to upgrade grain transportation railbeds and infrastructure. The report estimated that \$320 million per year would have to be spent on grain cars, locomotives, and mainline railway improvements to handle projected volumes of grain. Even at five times the Crow rate, branch line subsidies by the federal government would still be required for the present system to operate (Alberta Agriculture 1980).

In a book published in 1980, Harvey calculated the losses to railways and the federal government through 1987 for both a minimum compensatory rate (variable costs only) and for variable plus fixed costs. After deducting the statutory rate payments for the 10-year period from 1978 to 1987, variable costs were estimated at nearly \$3 billion and over \$3.7 billion if some of the fixed costs are included (branch line rehabilitation costs excluded). Using estimates provided by Snively (1978) (the distribution of cost among the producers, the federal government, and the railways being 32.4 percent, 18.0 percent, and 49.6 percent respectively) the railways would, with no other subsidies, suffer a financial loss from transporting grain of between \$1.5 and \$1.8 billion during the 10-year period (Harvey 1980).

**Table 36. Summary of federal government spending since 1970
on statutory grain transportation-related projects***

Program	Federal Spending (000,000)	Details
Leasing Rail Cars	\$ 1.3	1972-Leasing railway rolling stock while awaiting delivery of new hopper cars
Repair of Box Cars	\$ 14.3	1974 - 2400 Box cars 1979 - 3000 Box cars
Purchase of New Cars	\$ 257.8	1972 - 2000 cars 1976 - 4000 cars 1977 - 2000 cars
Branch Line Rehabilitation	\$ 163.3	
Branch Line Compensation in Western Canada	\$ 662.1	
Subsidy on Rapeseed Meal and Oil	\$ 6.8	Government subsidy on meal and oil to cover difference between current freight rate and 1976 rate
TOTAL	\$ 1,105.6	

Source: Alberta Agriculture 1980.

* Update of information gathered by Grains Group - Ottawa

COST TO THE PRODUCERS

The most significant cost of the present transport system for Alberta grain producers may be the hidden cost of export sales not completed due to the inability to move the required quantity, type, and grade of grain to export position on time. It has been estimated that deferred and lost sales during the 1977-78 and 1978-79 crop years resulted in the loss of over \$1 billion in gross revenue (Alberta Agriculture 1980). International demand for grain has been rising rapidly during the past several years. During the 10-year period from 1966 to 1976 international sales of grain increased 60 percent. At the same time Canadian sales of grain increased only 4 percent and the Canadian market share of international trade declined by nearly 6 percent (Alberta Agriculture 1980).

There are two additional problems stemming from this inability to meet international demand. First, lost and deferred sales have not been caused by slow production gains. Sufficient grain is being produced to maintain the Canadian market share in international trade. Since the supplies are available but not shipped, storage of the excess stocks increases the cost to the producer. On-farm storage is expensive and full elevators and terminal facilities further decrease the ability of the handling and transportation system to cope with the following crop year's production. A second problem caused by inadequate grain transportation arises from lost confidence in Canadian ability to fulfil future contracts on time. Delays in grain delivery can have disastrous economic and political consequences in importing countries, making reliable, timely supply an extremely important criterion for grain purchasers.

As with other aspects of the Crow rate controversy, the cost to the producers of eliminating the rate has led researchers to differing conclusions. One study done for Alberta Agriculture concluded that the total indirect and direct value-added cost to the prairie provinces for compensatory rates would be \$611 million over a 25-year period (Anderson and Hendricks 1978). According to their calculations, Alberta agricultural products would increase in value by \$190 million while Manitoba would lose \$33 million and Saskatchewan \$721 million. The advantage to Alberta lies in the livestock and food processing sectors which were projected to gain \$51.5 million and \$19 million per year respectively.

Another study estimated that producers would suffer a decrease in gross cash income of between 6.5 and 8.5 percent from the sale of wheat alone, depending on the rate at which transportation charges were established (minimum compensatory rate or this rate plus 20 percent). The report also concluded that Canadian foreign exchange earnings from wheat would decrease by 2.9 to 3.8 percent (Nagy et al. 1979). This study did not consider two important factors. First, the authors excluded all prairie agricultural commodities and secondary processing industries except wheat from the study. Second, no improvement in rail service to grain producers due to higher freight rates was assumed to occur. Each of these factors could affect the Alberta economy in a positive manner if the statutory rate was abolished or altered.

A more recent study included the potential impact of these two factors in the calculations of freight rate change and economic impact. Using the same data as Anderson and Hendricks but assuming a 10 percent increase in quantity sold, it was estimated that rather than costing prairie grain farmers more, they would in fact benefit from a cost compensatory

freight rate (Alberta Agriculture 1980). This study concluded that a change in the freight rates to cost compensatory levels would "significantly increase net farm income, especially in Saskatchewan" (Alberta Agriculture 1980:67). Since the improved railway capacity would presumably reduce the expense of storing unsold grain stocks, "producer net income would be substantially improved" (Alberta Agriculture 1980:67). It is not unusual in this controversial issue to find two studies with only slightly different assumptions, such as that directly above and the Anderson-Hendricks report cited earlier, reaching directly opposite conclusions. One says Saskatchewan would suffer most; the other says the major benefits to the grain sector would accrue to Saskatchewan.

M.S. Fleming and I.H. Uhm predicted that small-scale grain farms with less total grain production would be negatively affected by a change in the Crow rate to a greater extent than larger farms. They conclude that "the long-run trend towards larger farms may be accelerated in that smaller farms may not be able to survive under this additional cash flow squeeze," caused by rail line rationalization (Fleming and Uhm 1981:29-30).

Whether the impact of a change in the Crow rate would be negative or positive for Alberta grain producers, most studies agree that the livestock industry and secondary food processing industries such as beef processing and oilseed crushing would benefit from compensatory rates. One study done for the Alberta Cattle Commission concluded that the direct annual loss to the Alberta agricultural economy was between \$125 and \$182 million, primarily because of the inhibiting effect of the Crow rate on the livestock industry. Calculating direct and indirect losses (\$336 million) as well as including a multiplier effect for income not spent, total losses to the Alberta economy were estimated to be between \$700 million and \$1 billion per year (MacEachern 1978). In addition, MacEachern estimated that land values for land capable of producing 40 bushels of barley per acre have increased by \$142 per acre, assuming the entire Crow rate advantage has been capitalized into land values. Other factors may enter into the ability to capitalize net benefits of the Crow rate into land values, but the above figure was presented as a maximum (MacEachern 1978). Although impact on land values was not quantified, a reduction in land values was projected over the long-run in a study of the effects of rail rationalization programs on Saskatchewan grain producers (Fleming and Uhm 1981:30).

Other studies disagree on the magnitude of increased livestock production in Alberta potentially resulting from a change in the Crow rate. The Hall Commission report states that there is no economic advantage in shipping prairie feeder cattle plus the grain needed for finishing to eastern Canada (Hall 1977), but corn competitive pricing may have changed the balance since that time. A study done by Alberta Agriculture concludes that the livestock industry in Alberta would be positively affected by compensatory rates, but that the cyclical nature of livestock production throughout North America exerts a stronger influence on cattle production (Alberta Agriculture 1980). This study and others report that expansion of this sector would be less dramatic than predicted by MacEachern (Harvey 1980, Canada West Foundation 1980).

WHO SHOULD PAY?

Given a widespread, although not unanimous, agreement that the railways should be compensated for grain transportation at a higher level than the Crow rate, the question arises:

Who should pay? There are essentially three primary candidates and one longer term possibility. The three are: the producer, the federal government (taxpayer), and the railways. The fourth contender is some combination of provincial and federal government funding such as the recently discussed (in the media and Legislature) possibility that Alberta would establish its own grain handling, transport, and marketing systems.

It has been argued that the producer should begin to make up the Crow gap costs because he will reap the major benefits. Compensatory payments to the railway will generate increased system capacity and improved efficiency since grain hauling will be profitable and will thus encourage the railways to increase their ability to move grain. The counterarguments to this position are that first, the railways have a captive market and near monopolistic control of grain transportation to terminal ports and therefore will only improve the rail system to the minimum level required to keep up with immediate demand regardless of the freight rate. Second, some argue that CP Ltd. has expanded their operations through diversification into other areas simultaneous with the deterioration of the grain transportation system. This expansion leads some to believe that returns from grain hauling have been adequate and have allowed the railway company to expand into other profitable markets (Alberta Agriculture 1980). The railways of course may contend that their diversification was necessitated by huge losses resulting from grain transportation and the argument comes full circle.

A second argument against making the producer pay for the Crow gap is that a bargain was reached when the Crow rate was established in exchange for certain benefits to the railway and that this bargain should be kept (NFU 1981). Others believe that keeping this bargain is in fact detrimental to the prairie economy since various prairie agricultural industries are discriminated against under the present Crow rate system. In addition, the original bargain established the Crow rate for a relatively small number of delivery points along main line trackage to a single terminal port and was set for grain and flour only.

Those believing that the federal government is responsible for compensating the railways often claim that the Crow rate was established and made statutory as part of a policy of encouraging development throughout Canada. Central Canada has tariff barriers to protect the manufacturing industries from foreign competition, the Maritimes have various assistance programs, and the prairies, therefore, have a right to the Crow rate since producers could not afford to pay the full cost of grain transportation to export markets (NFU 1981). In addition, grain and grain products exported from Canada have a substantial positive impact on our precarious international balance of payments situation and thus benefit all Canadians.

Arguments against full federal obligation for compensating the railways for grain transportation often concentrate on the escalating costs from expansion of the system, maintenance of uneconomic rail lines and the enormous volumes carried. Others contend that the Crow rate is now retarding prairie agriculture rather than encouraging growth and that Alberta's natural locational advantage would be sufficient to bolster the prairie economy without subsidized freight rates. Under the latter assumption, federal subsidies paying the Crow gap would be counterproductive to diversified economic development, especially if other prairie industries such as coal mining and the potash industry must pay higher than normal rates to make up for railway losses from the Crow rate. A recently issued report prepared for the Alberta Department of Economic Development recommends that the provincial governments of the three prairie provinces acquire ownership of the light-density branch lines in

their respective jurisdictions (Horner 1981). The advantages of this proposal were said to be a reduction of the Crow gap by 20 to 25 percent (for the federal government), a transfer of responsibility for local transportation to the provincial governments allowing enhanced opportunities for integrated planning, and a separation of branch line funding from the total cost of grain transportation allowing the federal government to continue or increase funding for subsidized freight rates.

Counter-arguments presented in the report include the need for a substantial financial commitment for capital and maintenance by the provinces as well as difficulties arising from a change in ownership and management. In addition, the provinces would be forced to make future decisions regarding branch line abandonments which would likely entail local political controversy.

Some groups feel that the railway companies should continue to pay the Crow gap. They argue that the railways are obliged to transport agricultural products for the established rate since the CPR received considerable advantages from the original agreement. The counter-position taken by the railways is that the original agreement was vastly different from the present obligation. In addition, the CPR contends that by making the Crow rate statutory in 1925, Parliament effectively made the original agreement null and void.

A second argument has been put forward to support the view that the railways are at least partially responsible for paying the Crow gap. Some believe that the railways should be compensated only for an efficient transportation system. To the extent that the railways' operations are inefficient and are maintained in less than satisfactory condition, compensation should be withheld. Those espousing this position often feel that the railways should be only partially compensated, based on their performance.

HOW COULD THE SYSTEM BE CHANGED?

Several proposals for changing the Crow rate to a cost-compensating rate have been presented by various groups. Nearly everyone agrees that the railways must receive a higher return for transporting grain. The proposals diverge from one another in four main areas. First, the question of who should pay the increase in the freight rate of three to five times the present level is highly controversial. Second, the level to which the rate should be increased differs among the proposals. Third, there is disagreement about to whom the differential should be paid: to the rail companies directly, or to the producers who then pay the railways according to volume shipped or acreage, etc. Fourth, there is the question of how to insure that the railways will indeed use the additional revenue from compensatory rates to upgrade the rail system and provide better service.

One proposal recommends that the federal government pay the railways a cost-compensatory rate with no immediate cost increases to the producer. The federal government would continue to pay for rail line improvement and maintenance on low-volume trackage. Both the federal and provincial governments would continue to purchase new grain cars at the rate required to transport a projected export total of 30 million tons in 1985. In addition, the Crow rate benefit would be extended to several other agricultural commodities not presently covered. This extension would alleviate many of the economic distortions caused

by the present system and allow natural locational advantages to play their proper role in the economics of agriculture (Wilson 1981).

Critics of this proposal are numerous and their critiques are persuasive. First, they argue that the transportation system would still operate without recognition of the true costs of shipping grain and would therefore have no incentive to improve other than in the cost reduction area. Second, the cost to the federal treasury would be very high initially with potentially huge future cost implications. Government expenditures would be directly linked to unknown future transportation costs of unknown future volumes of agricultural commodities. Third, extending the Crow benefits to other agricultural commodities could have serious negative implications for certain sectors of agriculture in central Canada. This very likely would lead to additional provincial support programs for the livestock industry in Ontario and Quebec. Such programs may maintain economic inefficiencies at substantial costs to taxpayers while continuing the trend toward interprovincial trade barriers. Fourth, there is no direct assurance that the railways would be willing to increase their capital expenditures for mainline improvement and rolling stock sufficient to meet future export requirements.

A second proposal presented by "a coalition of prairie commodity groups" recommended that the federal government pay producers the difference between the Crow rate and federally controlled compensatory rates. Payment to the producers "would be based on acreage, productivity, and volume, and in 1979 terms they would total about \$350 million annually" (Wilson 1981:181). Producers would be responsible for paying future cost increases and the railways would guarantee reinvestment in the grain transportation system. The concept of variable rates to be established by the railways, subject to approval by Ottawa, was included in the package. Rates were to be established at a maximum with the railways given the right to reduce rates for particularly efficient delivery points. It was felt that variable rates could be used to encourage more efficient operations (Wilson 1981).

Some critics of this plan oppose the variable rates on grounds that the railways would use them to eliminate low-volume branch lines to the detriment of relatively isolated rural areas. Other criticisms of the proposal are that the administrative costs of making payments to the producers would be very high and arriving at an equitable formula for payments to the variety of producers across the prairies would be extremely difficult (Hall 1977). Since the payments from Ottawa would be tied to the volume of grain moved, endlessly increasing subsidies by the federal government may be integral to the plan. One final problem with the plan is that the railways may be unwilling to agree to a performance bond since many variables not under railway control could affect performance.

A third proposal often expressed, most recently in the Canada West Foundation report *Western Canadian Agriculture to 1990*, calls for government ownership of all railbeds, with railway companies hauling grain and presumably other commodities under license to government. Licensed carriers would either haul products in competition with each other to keep rates down, as recommended by the Canada West Foundation Task Force, or the carrier rates would be set by government.

Advocates of this proposal contend that it is unrealistic to expect railway companies to be able to compete with truck or aircraft freight rates since the federal and provincial governments pay the entire cost of highways and airports. They argue that truckers and airlines have only to pay for their vehicles, maintenance facilities, and infrastructure while railways must build and maintain very expensive railbeds, thus placing the latter in an untenable position. Commercial truckers claim that licensing fees cover some portion of highway costs and that they are therefore not escaping capital improvement costs.

Regardless of the comparability of capital costs to commercial carriers among highways, airports, and railbeds, the major objection to this proposal is the high continuing cost to the federal government. It is possible that maintaining and expanding the railbed would be less costly in the long run than compensating producers or railways for costs above the statutory rates, particularly if total production and export potential increases by 30 to 50 percent in the next few years. However, dramatic increases in exports of other commodities not included under the statutory rates, such as coal, potash, and forest products, could give rise to rapidly deteriorating railbeds and very expensive demands for maintenance and expansion of the railroad system, which would then be financed by taxpayers. Government assumption of responsibility for railbeds simply because of problems in shipping agricultural products may not be cost effective since the statutory rates only apply to about 30 percent of total volume shipped. Whether this cost is politically justifiable has not been studied as far as can be determined.

The Crow rate reform proposal recommended by the Horner report (1981) would separate responsibility for the branch lines from the remainder of the transportation system. This separation would presumably allow the federal government to shift its present allocation of approximately \$200 million per year for branch line rehabilitation to additional compensation for the railways under a renegotiated rate structure. In addition, a "value-added commission" would be established in each prairie province which would use funds from an export grain levy to increase grain and livestock processing in the prairie provinces. The efficiency of the grain transportation system should improve due to compensatory rates paid to the railway combined with provincial management of the local transportation infrastructure (Horner 1981).

Numerous variations on the three plans have been presented by other interested groups. The major barrier to acceptance of any of the proposals is a lack of predictability of the result. Several studies have been done showing the present cost of the Crow rate system, but economics is not nearly precise enough to calculate future costs of grain handling and transportation systems currently on the drawing board.

The most recent development as of this writing (February 1982), was the appointment by Federal Transport Minister Jean-Luc Pepin, of Clay Gilson, a professor of agricultural economics, as negotiator for achieving consensus among western Canadian farm organizations on changes to the Crow rate structure. At the same time, Mr. Pepin committed the federal government to paying the Crow gap at the level established for the 1981-82 crop year. Costs of future increases in freight rates are to be shared by producers, the federal government, and perhaps by other parties. The announcement was met with very mixed reactions among western agricultural groups. Dr. Gilson may be faced with a Sisyphean task in his attempt to

arrive at an agreement on Crow rate reform among such diverse prairie farm groups as the National Farmer's Union and the Alberta Cattle Commission.

In short, there is no consensus on the most appropriate solution to the problems of transportation of grain and other agricultural products. Nevertheless, the quality of the transportation system and the magnitude of future costs are critical to the economics of farming in Alberta.

It is impossible to describe the economics of agriculture in Alberta without considering transportation. It is equally impossible to make any forecast of what the final transportation solution will be. The analysis presented here is not intended to be comprehensive, but only to indicate the complexity and the controversy that surround the question of grain transportation. The solution finally adopted will have a substantial impact on the economics of farming in Alberta, with the potential to dampen or expand demand for products of Alberta's agricultural industry, or to change the form of that demand.

It is unsatisfactory to examine such a major factor of the agricultural economy and conclude that the only firm conclusion is uncertainty, but that is all that can be done at the present time. However, this section perhaps explains some of the background and causes of this uncertainty.

MARKETING BOARDS

It is the responsibility of the marketing board to develop and maintain a marketing program for its product. The board is responsible for the development of a marketing plan, the implementation of the plan, and the evaluation of the plan. The board is also responsible for the development of a marketing budget, the implementation of the budget, and the evaluation of the budget. The board is also responsible for the development of a marketing organization, the implementation of the organization, and the evaluation of the organization. The board is also responsible for the development of a marketing strategy, the implementation of the strategy, and the evaluation of the strategy.

Marketing boards are established by the government to promote the production and sale of certain agricultural products. The board is responsible for the development of a marketing plan, the implementation of the plan, and the evaluation of the plan. The board is also responsible for the development of a marketing budget, the implementation of the budget, and the evaluation of the budget. The board is also responsible for the development of a marketing organization, the implementation of the organization, and the evaluation of the organization. The board is also responsible for the development of a marketing strategy, the implementation of the strategy, and the evaluation of the strategy.

There are several reasons why marketing boards are established. The first reason is to promote the production and sale of certain agricultural products. The second reason is to stabilize the market for these products. The third reason is to provide a source of income for the producers of these products.

1. To promote the production and sale of certain agricultural products.
2. To stabilize the market for these products.
3. To provide a source of income for the producers of these products.
4. To provide a source of information for the producers of these products.
5. To provide a source of information for the consumers of these products.
6. To provide a source of information for the government.
7. To provide a source of information for the public.
8. To provide a source of information for the private sector.
9. To provide a source of information for the international community.
10. To provide a source of information for the future.

The marketing board is responsible for the development of a marketing plan, the implementation of the plan, and the evaluation of the plan. The board is also responsible for the development of a marketing budget, the implementation of the budget, and the evaluation of the budget. The board is also responsible for the development of a marketing organization, the implementation of the organization, and the evaluation of the organization. The board is also responsible for the development of a marketing strategy, the implementation of the strategy, and the evaluation of the strategy.

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DEFINITIONS AND OBJECTIVES

In light of recent publicity concerning national and provincial marketing agencies for various agricultural commodities, and the controversy surrounding the topic, a brief discussion of marketing boards in Alberta appears to be essential to an understanding of possible future trends in agriculture. The discussion which follows is based on this definition of a marketing board: "a marketing board is considered to be a compulsory marketing institution which performs any of the functions of marketing on behalf of the producers of the particular agricultural commodity" (Veeman and Veeman 1980:4). Under this definition, marketing boards vary in responsibility from merely promotional functions (Alberta Cattle Commission) to complete supply and price control throughout the industry within provincial boundaries (egg marketing boards).

Boards are usually established only after a majority of producers have voted for implementation. After implementation, the jurisdiction of the board applies either to those producers voluntarily joining the organization or in some cases, to all producers regardless of their marketing preference. The Alberta Pork Producers Marketing Board is an example of a board whose primary objective is to provide a centralized selling service to equalize producer marketing power in dealing with the small number of packers in the province. The Alberta Dairy Control Board is an example of a supply and price control board which establishes prices based on various cost factors and the consumer price index (Veeman and Veeman 1980).

There are several reasons advanced for establishing marketing boards for agricultural commodities:

- 1) To resist instability in certain commodity markets.
- 2) To equalize market power between the numerous producers and the relatively small number of buyers.
- 3) To assure producers of a relatively stable profit margin in the face of rapidly rising input costs.
- 4) To ensure equality of access to market for producers regardless of the size of operation.
- 5) To restrict entry by new producers in order to stabilize total production and thus maintain prices.
- 6) To enhance provincial self-sufficiency in certain agricultural commodities.

ISSUES IN DISPUTE

The historical view of prairie agricultural production as an economic sector has been that it exemplifies near perfect competition. The tens of thousands of individual producers had no possibility of influencing the price they received for their product either on the domestic or international market. To a degree this is still the situation; no individual or small group of producers is able to affect the price they will receive. However, the evolution of national and provincial marketing boards has increased the market power of certain groups of producers by eliminating internal competition and presenting a common front to processors, wholesalers, and consumers. Large-scale marketing has improved the economic picture for many prairie producers. At the same time, new entrants to agriculture have been frustrated

by restrictions on entry to some types of commodity production (eggs, broiler chickens, fluid milk, and turkeys).

During the past two years agricultural marketing boards have been the subject of a great number of economic evaluations, many of them critical (Arcus 1981, Barichello 1981, Borcharding and Dorosh 1980, Haack et al. 1981, Josling 1981, Plain and Hankedal 1981a and 1981b, Veeman and Veeman 1980, Martin 1981). On the other side of the ledger, some producer groups and governments are advocating increasing the powers of some agricultural boards to include supply management (for example, Ontario Cattleman's Commission, groups favouring a strong Saskatchewan beef stabilization plan, federal Agriculture Minister Eugene Whalen's advocacy of supply management for beef and hogs). Although the Alberta Cattle Commission and the Alberta Pork Producers Marketing Board do not favour establishing supply management, there is some concern that stabilization programs and subsidies in other provinces may force national/provincial agreements on marketing boards for cattle and hogs to prevent inequities among provincial programs resulting in variable prices (Whalley 1980, Haack et al. 1981). This move toward provincial self-sufficiency in many agricultural commodities not particularly well suited to the respective jurisdictions may be politically popular, but could and perhaps already is causing distortions in the Canadian market. There are numerous provincial and federal programs which discriminate against interprovincial trade in certain commodities (Haack et al. 1981, Horner 1981).

Several basic criticisms of supply control marketing boards are presented by economists. One of the most common issues raised is the question of quotas. There are three ways in which quotas are initially allocated:

- 1) based on past production over a specified period;
- 2) based on present capacity to produce; or
- 3) based on sales of quota at auction or by other means (Plain and Hankedal 1981a).

When it becomes necessary to expand quotas, the board may allocate additional production proportional to present production, by selling the opportunity to produce more, or by opening the quota allocation to new entrants. The major controversy over quotas concerns the capitalization of the value of the quota into the land, buildings, machinery, or other assets of the quota holder.

When quotas are distributed under conditions of supply control and/or price management, the quota itself takes on a value independent of the farming operation for two reasons. First, no new entrants to production are allowed, thus creating an artificial scarcity in an economic sense. Persons wishing to participate in the industry must obtain a quota before their product can be marketed. To the extent that a marketing board is able to raise prices and income to producers under board control, the quota increases in value. A quota can further increase in value if the expectation of future rises in profit margin is capitalized into the farming assets.

Second, the producer operating under a supply/price control marketing board has a reliable profitability since internal competition among the producers of that commodity is eliminated. When producers retire or sell their assets with a quota right attached, the purchaser must pay for not only the capital assets of the operation, but also for the right to market access and reliable profitability provided by the quota. The quota value and expected future

benefits from the supply management system are not transferred to the new owner to the extent that these values have been capitalized into the business (unless the seller made a poor business transaction). The value of these benefits is taken out of the system by the retiring quota holder (Plain and Hankedal 1981a, Veeman and Veeman 1980, Arcus 1981). Because new producers had to purchase the capitalized quota value, "prices (relative to costs) must escalate over time in order to establish benefits for those producers replacing the original producers" (Arcus 1981:53). In other words, the only benefit second-generation producers under supply/price control conditions have is the potential to expand their profit margins or total profit further either through board action on price or an expanded quota. A second problem caused by quota allocations is a perceived misallocation of initial provincial quotas due to historic production patterns which may have been based on previous market interventions (see Table 37). Dissatisfaction with quota allocations usually occurs only with

Table 37. Provincial shares of the national industrial milk and national egg markets and population

	Industrial Milk (%)	Eggs (%)	Population (%)
Alberta	6.71	8.704	8.5
British Columbia	3.09	12.055	10.9
Manitoba	3.90	11.480	4.4
New Brunswick	1.33	1.828	3.0
Newfoundland	0.00	1.785	2.4
Nova Scotia	1.21	4.106	3.6
Prince Edward Island	1.88	0.637	0.5
Ontario	31.32	38.161	35.9
Quebec	47.96	16.566	26.5
Saskatchewan	2.60	4.760	4.0
Canada	100	100	100

Source: Haack et al. 1981 and Alberta Treasury 1981.

national marketing boards. A great deal of negotiation is required to establish initial production quotas for individual provinces within a national supply management scheme. No group of provincial producers would willingly suffer a decrease in production for their members for the benefit of producers in another province.

This situation would very likely be particularly problematic in the case of a national hog marketing board. Quebec has dramatically expanded its share of the national market in recent years (Whalley 1980) and would be unlikely to willingly reduce its share of the quota pie. On the other hand, prairie hog producers may feel that their share of the national market should be returned to the 1971 level of 46 percent compared to only 29 percent in 1979 (Whalley 1980). Their case may be bolstered by evidence that during the seventies in the hog industry "the influence of economic forces has been subordinated by administrative action" (Whalley 1980:53). By administrative action, Mr. Whalley is referring not only to "tariff and non-tariff barriers to international trade, but hog production subsidization programs in other areas, non-compensatory feed-grain freight rates, and buyer market power (to name a few)" (Whalley 1980:54). Roughly interpreted, that means Alberta pork producers are unlikely to agree to any permanent status under quota for existing provincial market shares. The same could be said to a lesser extent for Alberta cattlemen.

Unfortunately, initial allocation of quotas is not the only inequity perceived by producers. Some mechanism for changing quota allocations among provinces (again under a national supply control board) must be established. Shifts in population from eastern to western Canada may encourage western producers to lobby for expanded quotas which may be at the expense (in terms of production) of eastern producers. Quebec egg producers have been in some difficulty with the Canadian Egg Marketing Agency for various reasons, but an underlying cause may be Quebec's underallocation in the national quota pie relative to the population, if population is to be used as a criterion for quota allocation. On the other hand, every province except Quebec, P.E.I., and Newfoundland has some justification for wanting a redistribution of the industrial milk quota, already in oversupply. Since the latter is by far the most heavily subsidized agricultural product, with about \$1,000,000,000 in net transfer per year from 1976 to 1979 (Josling 1981), a good case may be made for substantial quota reductions in several provinces (see Table 37). Equitable quota adjustments remain a fundamental problem with supply management marketing boards.

The economist's attacks on agricultural marketing boards often centre on alleged economic inefficiencies which are said to be inherent in any supply-limiting market strategy. Economic efficiency is defined to mean the "most effective use or allocation of resources... (labour, management, machinery, new technology) to achieve the lowest possible production cost" (Crane 1980:104). Most of the inefficiencies in marketing board activities cited by economists stem from the interference with free market forces inherent in supply management and price control. It is said boards with such powers are essentially monopolistic control mechanisms which replace nearly perfect competitive conditions among producers who, in turn, must sell to oligopsonistic buyers such as meat-packing firms (Plain and Hankedal 1981a). The specific charges levelled at supply- and price-controlling boards originate with the quota mechanisms and the price determination methods.

Quotas prevent the entry into the market of new producers who may have innovative management techniques or more capital intensive or cost-effective operations. Producers

currently under quota allocation are unable to expand their operations to take advantage of potential unit cost reductions from optimum production volume. Quotas allocated on a provincial basis often prevent natural locational advantages from playing a role in production and market distribution. Various techniques for preventing interprovincial trade in supply-managed commodities have been established as a result of quota allocation. Control of less expensive imports may be essential for marketing boards to succeed, which provides a disincentive for domestic producers to cut costs and improve on-farm efficiency. At the same time, quotas may prevent aggressive international marketing of agricultural products which could be produced at a lower cost in Canada.

The quota system may slow response to changed demand in either the domestic or international market. In addition, combined with Board-established pricing, quotas do not allow price reductions to stimulate demand when the market is weak, resulting in an inability to sell the product. This situation occasionally results in wasteful destruction of agricultural products, such as eggs which have been in storage too long, or necessitates killing off layers when production outstrips demand at Board-established prices. The rationale for not reducing prices to clear the excess product is that demand for domestic agricultural production is relatively inelastic, and to reduce prices to consumers would only marginally increase consumption of, for example, fluid milk, broiler chickens, or eggs. Despite the fact that these types of agricultural products do have a relatively inelastic demand curve (that is, a 1 percent decrease in price would result in less than a 1 percent increase in demand), there could still be substantial substitutions of cheese, poultry, or eggs for beef and pork under conditions of, say, a 30 percent decrease in price in order to make use of excess products rather than the alternative of destruction and burial.

Other criticisms have been laid at the feet of supply control marketing boards. According to one study cited by Arcus (1981) the processing industries realize lower gross margins due to higher fixed costs per unit of product caused by supply management. Moreover, there is little incentive for processors to upgrade their facilities since producer expansion is controlled and opportunities for export are unavailable because of supply control exercised to maintain high producer prices. Thus many processors must operate below capacity and must plan for low growth rates. Also, natural locational or distributional advantages are lost to processors just as they are to the producers.

In addition, storage costs for production in excess of that allowed on the market may increase costs to the board. These costs must be met either through reduced producer prices, increased government subsidies (for the few boards receiving significant government assistance), or most commonly, increased product prices to the consumer. Under conditions of excess production, boards often must store perishable products for too long to be able to provide consumers with a fresh commodity, in order to turn over stock in an orderly manner (for example, eggs).

The final and perhaps most important economic criticism of supply control marketing boards is that consumers pay substantially higher prices for these products than would be the case under more open market conditions. Each of the previously mentioned inefficiencies must be paid for somewhere in the production/processing/distribution/consumption system. Most of the recent economic evaluations conclude that the consumer pays for the bulk of these alleged inefficiencies through higher product prices. The total cost of

these inefficiencies for dairy products, sugar, broilers, eggs, and wheat, in terms of income transfers to farmers above estimated free market returns, amounts to nearly \$1.5 billion per year (Barichello 1981, Josling 1981, Arcus 1981).

It must be noted that these calculated costs are rough estimates and the real costs could be higher or lower. Equally important is the fact that serious economic dislocations may be caused by the elimination of some of these boards in that many economically inefficient agricultural operations could be squeezed out of existence. The short-run economic costs of a major restructuring of the entire agricultural sector of the economy would be very high and would also entail social and political consequences with a high price tag.

Farmers in Alberta have tended to resist the development of supply management marketing boards, generally to the applause of economists who see great virtue in the free market and probably with the endorsement of consumers who, if they think about it at all, should appreciate that their food costs have been minimized. However, there are powerful forces tending toward the establishment of supply management marketing boards, even in Alberta. Many of these forces are extraprovincial, originating with producers who do not have confidence in their ability to produce cheaply and compete effectively, an attitude seldom manifested by the Alberta farmer. However, if Alberta farmers continue to be subject to the severe real net income fluctuations typical of the late 1970s (particularly red meat producers), they may be more willing to succumb to the siren call of marketing boards with supply management powers.

One reason why the Alberta farmer has been so confident of his ability to compete effectively has been his trust in the security of his agricultural land base. He farms good-quality land capable of providing good yields, and his costs of production have not been out of line with his competitors in other parts of Canada. However, elsewhere in this report and in companion publications, it has been shown that the land base is not all that secure. Acidification, salinization, and nitrogen loss may all be leading to reduced productivity or higher input costs. In particular, the spill-over of urban and industrial land values because of the growth of other sectors of the economy (and labour prices as well) are beginning to place substantial burdens on the cost of farming in Alberta.

If the Alberta farmer loses confidence in his ability to compete due to these and related factors, the result could very well be a change of attitude toward supply management marketing boards and an increasing acceptance of boards as one way out of an intolerable dilemma.

A CASE STUDY: THE DAIRY INDUSTRY IN CANADA

Introductory Note

Recent suggestions that the beef and pork sectors be integrated into supply management systems have met with very mixed reactions both within Alberta and across the country. Comparing the beef and pork sectors with the dairy industry may be mixing apples and oranges, but no comprehensive study supporting the establishment of a Canadian beef and/or pork marketing board is known to this writer. The recently released report by Max Roytenberg (1981) to the Canadian Senate advocates but does not make an economic case

for supply management for the beef industry. The report for the Economic Council of Canada by Larry Martin (1981) is entirely negative toward supply management in either the beef or pork sectors. Martin suggests that supply management for beef and pork would be costly to implement, would require import controls due to higher Canadian prices, would reduce or eliminate potential exports to the United States, would have serious negative consequences for growth in these sectors, would reduce secondary benefits from the meat packing industry, and would create the equivalent of a regressive tax on consumers similar to that caused by supply management in the dairy and poultry sectors. By regressive tax is meant the increased consumer prices across the board to pay for supply management inefficiencies.

Roytenberg examined various types of beef market interventions "primarily from the producer's point of view" (Roytenberg 1981:1). The emphasis throughout this report is on the maintenance of a "broadly based industry." It is unclear whether "broadly based" means regionally throughout the country, or structurally in that 95,000 producers (58 percent of the total number of farms with beef cattle in 1976) had less than 20 cows each, or both. This large group of small producers had 17 percent of the beef cow herd in 1976 while 3.76 percent of the largest producers had one-quarter of the total beef cow herd (Roytenberg 1981:25). The various marketing systems described in the report which were acceptable to the author "provide the producers with a guarantee of costs plus a reasonable return" (Roytenberg 1981:146). The four models for market interventions in the beef industry are presented in great detail with the supply management option winning out among the contenders. Unfortunately a solid economic case is not provided for any of the specific interventions other than the generally accepted argument that the beef industry is in trouble, especially those producers with small herds.

Since the impact of supply management for beef and pork on the producers of Alberta would be quite substantial (44 percent of total farm cash receipts in 1980 were due to beef and pork sales), a major research effort should be initiated to examine the implications of supply management. The establishment of a supply and price control system on beef and pork without a rigorous examination of the effects would be similar to the recommended method of catching a porcupine attributed by H.J. Boyle to Mr. N.R. Crump, former president of the CPR: "Sneak up and slam a washtub over him. This gives you a place to sit and think about what you are going to do with him" (quoted from *Macleans*, 30 November 1981, page 8). The analogy breaks down with respect to the porcupine in that commodities under supply management tend to increase in value, hence cost to support, with the result that increasingly larger washtubs may be required while thinking.

The Dairy Industry in Canada

Although the dairy industry in Alberta contributed only 5.2 percent of total farm cash receipts in Alberta during 1980, the following discussion of the effects of marketing board control over this sector of agriculture is presented as an example of potential problems arising from supply and price controls.

The total farm cash receipts to the Canadian milk production industry rank third behind grain production and livestock, and constituted 13 percent of the total farm cash receipts in 1980 (Barichello 1981). Milk production and processing constituted 1 percent of the gross

national product in 1980 although consumers spend about 16.5 percent of their total food budget on milk and dairy products. About 30 percent of the federal agriculture budget is spent on the industry (more than for any other commodity), and federal support for the dairy industry is about 250 percent greater per dollar of farm cash receipts than for the grain sector, the next largest group (Barichello 1981).

Numerous problems beset the dairy industry in Canada. Demand has remained steady over the past several years (possibly as a result of prices rising twice as fast as those in the United States since 1974), and productivity is much lower than in the American industry. Canadian production per cow is about 30 percent less than in the United States and the gap is increasing. Net income in the dairy industry has been lower than average for Canadian farms but losses have largely occurred to dairy farmers with less than 33 cows in their herd (Barichello 1981). Three-quarters of the \$1,723 billion in farm cash receipts to the dairy industry go to Quebec and Ontario. In Quebec, 36 percent of the total farm cash receipts come from the dairy industry (Alberta Agriculture 1980, Barichello 1981).

Marketing Board Control

The Canadian Dairy Commission (CDC) is a federal agency primarily involved in the industrial milk sector of the dairy industry (about two-thirds of Canadian and half of Alberta production). The CDC policies include "recommending milk prices, supporting the prices for butter and skim milk powder, administering producer quotas (with the cooperation of provincial milk marketing boards) to limit production, distributing direct subsidy payments to producers, and undertaking certain trade and marketing functions" (Barichello 1981:17). During 1980 the CDC provided a 5.3 cents per quart subsidy to eligible Alberta producers of industrial milk with 2.5 cents per quart held back to pay for exporting dairy products and a .34 cents levy for the commission (Susko 1981).

In Alberta, the Dairy Control Board regulates quotas and production allocations to processors. Quota allocations remain associated with individual processing plants if they are transferred thus insuring a relatively steady supply to each processor, but at the same time preventing producers from delivering their product to alternative processors if and when conditions might warrant a redistribution. This system is different from most other provinces and may act to prevent consolidation of production into larger more efficient units (Andres and Veeman 1980).

Prices for fluid milk in Alberta are regulated by the Public Utilities Board. Base prices were established in 1973 from a voluntary cost survey of producers. Prices have been adjusted upward based on a series of economic indicators (revised in July 1980) including the average weekly industrial wage in Alberta, the index of farm inputs, and the price of alfalfa hay, among others. Total farm value (less federal subsidy) of milk production was about \$199 million in Alberta during the 1980-81 fiscal year (April 1980 to March 1981). Federal subsidies were estimated at \$17 million, or 8.6 percent of cash income, down from 11 percent the previous year (Alberta Agriculture 1981a).

An annual dairy cost study is conducted by the Alberta Department of Agriculture based on voluntary participation by a selected group of fluid (not industrial) milk producers in the province. In 1980, 57 producers out of 5,600 in the province provided information to the

study. Return to capital was estimated to be 10.6 percent, the return to family labour \$6.01 per hour, and the average productive value per cow to be \$933. The study estimated that total economic cost amounted to 99 cents per dollar income (Susko 1981). Elimination of the 5.3 cents subsidy less 2.5 cents for subsidizing export of industrial milk (over half of Alberta's production) would surely result in a major restructuring of the Alberta dairy industry.

Nationally, elimination of the direct federal subsidy would have a much greater impact due to the concentration of milk production in central Canada. According to R. Barichello, the direct cost to taxpayers for the present CDC/provincial board control of the dairy industry is \$303 million per year. This is not the most important cost, however. Because of higher prices charged for milk and dairy products caused by the supply control system, consumers pay nearly \$700 million per year to maintain the present control structure (Barichello 1981). Further, a gain of about \$300 million is realized by foreign importers of Canadian dairy products because world prices are less than domestic prices. In effect Canada is dumping milk products on the international market at a loss while subsidizing over-production through government subsidy and high consumer prices (Barichello 1981, Plain and Hankedal 1981a).

In his review of alternative government policies toward the Canadian dairy industry, Barichello concludes that of all the possibilities "only one incurs greater productivity losses than the current regime, and that is precisely the direction in which the program has been moving since the mid-1970s" (Barichello 1981:83). The policy he is referring to is a tendency to eliminate direct government subsidies paid for by taxpayers and subject to budgetary review and substitute increased price supports for dairy products, thus removing them from the federal budget and public review. This policy shifts the cost to the consumer, whose dairy product prices may soon support the entire structure. At first glance, this may be the more equitable policy since those consuming dairy products should pay the price. However, to the extent that consumer prices are subsidizing the export of dairy products at a loss and supporting a marketing structure which has been established by government, higher than necessary domestic prices amount to a regressive tax on Canadian dairy product consumers (and consumers of other products under marketing board control) with especially onerous consequences to low-income families and those with children.

Conclusions

Criticizing is always much easier than providing workable solutions to problems. Canadian agriculture faces severe problems in the 1980s. Declining political support for agricultural programs (Veeman 1980) combined with numerous and occasionally vitriolic attacks on costly government subsidies supporting agriculture may force some dramatic changes. The topic of marketing boards, no less than transportation rates for grain, will continue to be debated as agriculture struggles to keep up with a rapidly changing economic environment. Innumerable recommendations for alternative policies have been presented in dozens of reports, far too many for inclusion in an already overlong report.

Government intervention in agricultural commodity production and marketing pervades all aspects of the industry. The following quotation provides the best summary of government intervention in the Canadian agricultural sector this writer has seen:

The agricultural industry, like all North American commerce, has been proceeding for decades down a beckoning but dangerous path to overdirection and overcontrol. We have now reached the point where most of our corrective measures are counter-vailing policies to correct the errors or excesses of previous ones. It would be undesirable as well as practically impossible to completely dismantle the sophisticated rules that shape our markets. However, unless we are prepared to leave enough freedom in the market place for initiative to be rewarded, for excellence to be recognized, and for the inefficient to suffer the consequences, then our present state of confusion and stagnation can only deepen (Williams 1979:15).

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APPENDIX A

Input Costs

Table A1 Index conversion - farm inputs western Canada 1971 - 1980 (1971 = 100)

		1977				1978				1979				QUARTER								
		1st	2nd	3rd	4th	Year	1st	2nd	3rd	4th	Year	1st	2nd	3rd	4th	Year						
1.	Farm Inputs	100	107.0	125.0	145.3	164.0	176.2	181.2	182.5	183.9	181.0	189.8	198.7	203.3	210.6	202.6	233.0	237.4	237.6	253.8	260.8	260.4
2.	Building & Fencing	100	110.4	124.2	114.6	156.6	173.8	182.6	184.1	188.8	193.7	187.3	203.8	206.9	212.6	204.8	220.1	226.8	230.7	236.5	243.4	240.0
3.	Building Replacement	100	110.9	125.8	140.3	151.4	172.7	183.3	185.0	189.7	196.5	188.9	200.4	207.8	210.9	216.2	208.5	223.8	231.7	239.9	247.0	243.6
4.	Materials	100	113.2	130.2	141.3	145.5	161.4	169.5	172.1	175.3	184.2	175.3	190.1	199.4	200.5	208.2	199.0	219.1	226.3	231.4	234.8	231.0
5.	Labour	100	106.7	117.6	138.6	162.5	194.0	209.5	209.5	219.7	219.6	214.6	219.8	223.7	230.4	232.4	226.6	232.6	241.8	246.7	255.8	261.8
6.	Building Repairs	100	110.7	125.3	141.5	152.0	169.4	177.9	179.3	183.2	188.7	182.3	192.3	199.2	201.2	207.7	199.6	215.7	222.9	225.7	231.8	234.6
7.	Fencing	100	107.3	114.5	171.1	190.4	187.5	188.5	189.0	190.4	190.5	189.6	192.0	193.3	199.1	202.9	196.3	210.6	211.1	211.8	223.8	241.1
8.	Machinery & Motor Vehicle	100	103.6	107.9	121.1	140.3	153.1	160.1	163.9	165.4	169.9	164.8	173.4	174.6	176.1	182.0	176.5	187.7	190.6	194.0	203.4	232.7
9.	Machinery Replacement	100	103.2	107.2	120.3	139.6	148.6	156.3	157.7	159.7	164.8	159.6	171.1	172.8	175.2	183.5	175.7	191.4	194.2	198.5	209.5	230.8
10.	Power Machinery	100	102.7	106.5	119.2	141.6	151.0	159.0	160.4	162.4	167.9	162.4	176.2	178.6	181.6	190.5	181.7	198.8	203.0	207.6	219.7	234.9
11.	Tractors	100	103.1	106.9	119.1	142.1	150.3	157.1	158.1	159.9	165.0	160.0	173.1	175.8	178.7	187.1	178.7	195.5	199.9	204.6	226.6	240.7
12.	Combines	100	102.0	105.8	119.3	140.8	152.5	162.8	165.0	167.6	173.8	167.3	182.7	184.3	187.6	197.6	188.1	205.6	209.4	213.6	240.6	249.9
13.	Non-power Machinery	100	103.5	107.8	121.6	137.3	146.0	153.4	154.7	156.7	161.4	156.5	165.5	166.4	168.2	175.7	169.0	183.1	184.3	188.4	208.4	210.4
14.	Ploughs	100	103.2	107.2	119.1	138.2	150.6	153.7	155.8	158.1	163.0	157.7	166.9	169.9	170.2	176.7	170.2	181.9	184.6	188.6	205.2	210.4
15.	Disc Harrows	100	102.1	106.2	117.8	132.8	144.8	149.3	151.3	153.5	159.1	153.3	161.4	162.9	165.2	172.9	165.6	183.0	183.9	189.3	201.6	219.0
16.	Grain Drills	100	103.8	108.1	123.1	140.3	153.7	160.3	161.8	163.5	168.7	163.6	172.2	173.9	174.3	183.5	176.0	191.0	191.1	194.3	203.9	206.4
17.	Manure Spreaders	100	101.4	103.3	116.7	131.8	137.9	144.1	145.3	147.8	151.5	147.2	157.4	159.0	159.0	166.2	160.4	171.8	173.0	180.4	189.1	212.1
18.	Balers	100	105.0	109.5	122.2	138.3	144.7	153.6	154.4	156.1	161.0	156.3	166.3	167.6	170.8	177.5	170.6	185.1	187.0	191.5	199.7	210.9
19.	Motor Vehicles Replacement	100	103.5	105.9	117.9	130.8	137.2	145.4	147.3	148.1	153.7	148.6	161.0	161.4	163.4	173.0	164.7	178.1	182.0	184.6	191.6	203.4
20.	Automobiles	100	101.9	101.9	108.1	115.9	120.0	126.7	128.0	128.4	132.6	128.9	135.7	136.7	137.4	143.3	186.3	176.7	191.5	195.2	205.6	171.6
21.	Trucks	100	104.2	107.7	112.4	137.5	144.9	153.8	156.1	157.0	163.3	157.6	172.3	173.0	175.1	186.3	176.7	191.5	195.2	198.9	201.7	212.8
22.	Machinery & Motor Vehicle Op.	100	103.8	108.7	122.0	142.1	158.0	164.4	169.9	171.2	175.1	170.2	176.5	177.5	178.5	182.5	178.7	187.1	189.9	192.9	201.7	210.9
23.	Petroleum Products	100	103.0	108.8	119.7	144.5	166.7	172.3	180.9	182.8	189.2	181.3	190.5	189.6	189.8	191.8	190.3	194.3	195.2	196.2	200.8	203.4
24.	Maintenance	100	104.6	108.9	124.4	141.7	151.6	158.3	161.7	162.8	165.3	162.0	167.0	169.7	171.4	177.5	171.4	184.1	188.5	193.4	203.9	212.1
25.	License	100	103.5	102.7	102.7	103.6	104.3	107.3	112.0	112.0	112.0	110.8	112.2	112.2	112.2	112.2	112.2	112.2	112.2	112.2	112.1	121.1
26.	Motor Vehicle Insurance	100	101.4	107.3	107.3	107.3	107.3	107.3	107.3	107.3	107.3	107.3	107.3	107.3	107.3	107.3	107.3	107.3	107.3	107.3	107.3	217.6
27.	Crop Production	100	103.7	119.7	119.7	119.7	236.6	229.5	216.1	219.7	220.4	222.4	219.7	218.6	215.2	215.2	227.4	241.4	250.6	256.5	251.2	306.6
28.	Seed	100	96.2	113.6	113.6	281.8	242.0	220.4	221.1	221.1	221.1	220.9	214.7	215.2	215.2	215.2	215.2	221.5	223.0	223.0	300.1	310.5
29.	Grains	100	87.5	114.4	114.4	189.5	171.2	243.6	244.2	244.2	244.2	244.1	243.9	243.9	243.9	243.9	243.9	243.9	243.9	243.9	305.8	306.2
30.	Legume & Grass	100	106.5	116.7	116.7	189.6	222.9	212.7	219.4	219.5	220.9	218.1	217.5	221.1	233.2	243.5	233.6	253.9	266.0	276.5	267.8	289.0
31.	Fertilizer	100	106.4	116.9	116.9	189.9	223.3	212.7	219.6	219.6	220.9	218.1	217.8	221.4	233.9	244.6	234.3	254.9	267.3	278.0	269.1	312.4
32.	Fertilizer Materials	100	109.8	110.7	110.7	180.8	212.6	213.3	212.5	215.0	215.2	214.0	210.3	210.3	210.3	212.4	212.4	211.7	226.9	228.2	233.7	306.5
33.	Mixed Fertilizer	100	107.7	108.7	108.7	235.8	243.0	239.0	239.0	239.0	239.0	239.0	239.0	239.0	239.0	239.0	239.0	239.0	239.0	239.0	334.1	306.5
34.	Pesticides*	100	107.7	108.7	108.7	235.8	243.0	239.0	239.0	239.0	239.0	239.0	239.0	239.0	239.0	239.0	239.0	239.0	239.0	239.0	334.1	306.5
35.	Twine**	100	111.6	152.7	162.3	161.0	163.2	154.8	166.0	166.0	166.0	162.9	162.4	180.0	209.8	221.6	228.0	209.5	264.2	271.4	263.7	262.4
36.	Animal Production	100	117.8	152.6	129.3	123.9	127.1	199.3	129.5	133.5	138.1	130.1	159.9	206.0	227.1	238.9	208.2	294.5	298.4	270.6	259.4	280.7
37.	Feeder Livestock	100	112.7	144.8	121.3	96.9	103.0	100.2	109.4	114.7	121.7	111.5	139.6	188.0	192.1	221.0	190.3	285.3	296.1	274.2	267.4	280.8
38.	Cattle	100	163.9	230.0	190.7	325.9	305.3	256.8	280.0	275.6	264.3	269.2	322.3	369.2	376.4	414.1	370.6	424.6	376.4	290.0	240.8	333.0
39.	Hogs	100	102.5	113.6	132.9	138.9	143.1	146.3	141.9	142.3	142.8	143.3	149.4	149.4	149.4	151.9	150.6	156.4	158.8	165.0	162.6	165.6
40.	Chicks	100	100.6	103.0	120.6	120.2	128.3	119.3	120.6	119.0	119.1	119.5	125.8	125.8	125.8	127.0	129.6	131.2	129.1	136.7	141.7	143.6
41.	Turkey Poults	100	102.6	158.9	223.3	226.8	224.3	213.3	222.1	215.6	200.9	213.0	211.9	216.1	213.3	211.6	212.1	219.3	233.1	258.1	273.5	246.0
42.	Feed	100	101																			

Table A-2. Alberta farm input prices

Farm input prices continued to escalate in 1980, particularly for energy-related products. Figures A 1 to A 6 illustrate the price changes monthly as reported by the Alberta Input Monitoring System over 1980. These escalations are summarized below.

Less than 5% Increase		Less than 5% Decrease	
Plywood	+ 3 %	Penicillin	— 3.6 %
Vitamin A D E	+ 3 %	Reinforcing Rods	— 4.7 %
Tetracycline	+ 4.6 %		
Seed, Wheat	+ 3.3 %		
Seed, Barley	+ 4.8 %		
5% -- 10% Increase		More than 5% Decrease	
Farm Labour	+ 9 %	Lumber	— 19.6 %
Cement	+ 9.8 %		
Double Disc	+ 7.6 %		
1/2 Ton Truck	+ 7.5 %		
Calf Starter Supplement	+ 9.3 %		
10% — 20% Increase		More than 20% Increase	
Paint	+ 14.8 %	V-belts	+ 20.3 %
Plastic Pipe	+ 12.8 %	Antifreeze	+ 22.1 %
Barbed Wire	+ 13.9 %	Baler Twine	+ 32.2 %
Truck Tires	+ 14.5 %	Feed Barley	+ 31.4 %
Batteries	+ 10.3 %	Hay	+ 21.7 %
Mechanical Repairs	+ 10.6 %	Fertilizer 11-48-0	+ 20.3 %
Tractor 100 hp	+ 14.4 %	2, 4—D	+ 32.7 %
Tractor 170 hp	+ 12.8 %	Purple Gas	+ 31.7 %
Combine	+ 16.6 %	Diesel	+ 34.1 %
Cultivator	+ 18.7 %	Propane	+ 30.7 %
Baler	+ 15.6 %	Natural Gas	+ 28.6 %
Dairy Supplement	+ 12.1 %		
Hog Concentrate	+ 12.3 %		
Cattle Mineral	+ 17.9 %		
Fertilizer 34-0-0	+ 13.2 %		
Avadex	+ 16.5 %		

Source: Alberta Agriculture 1981d.

Table A-3. 1980 average farm input prices

		Jan - Mar	Apr - Jun	Jul - Sep (dollars)	Oct - Dec	1980 average
1.	Lumber	389.57	357.37	343.27	334.43	356.16
2.	Sheathing, Plywood	9.74	9.56	9.55	9.74	9.65
3.	Cement	5.38	5.63	5.73	5.79	5.63
4.	Paint	13.75	14.62	15.41	15.57	14.84
5.	Pipe, Plastic	15.96	16.70	17.22	17.69	16.89
6.	Rods, Reinforcing	5.04	4.87	4.90	4.86	4.91
7.	Barbed Wire	39.39	40.68	41.57	43.73	41.34
8.	Truck Tires	54.48	56.63	58.78	60.85	57.68
9.	Batteries	57.07	60.67	60.51	61.88	60.03
10.	V-belts	6.55	7.04	7.25	7.53	7.09
11.	Antifreeze	8.58	8.94	9.53	10.21	9.32
12.	Mechanical Repairs	21.27	22.16	23.03	23.18	22.41
13.	Baler Twine	20.71	24.09	26.22	26.28	24.33
14.	Farm Labour	871.86	900.65	922.63	943.69	909.71
15.	Tractor, 100 hp	36,138.00	37,246.68	38,341.14	39,810.00	37,883.96
15. 1	Tractor, 170 hp	59,510.97	62,644.03	64,112.96	65,205.42	62,868.35
16.	Combine Self-Prop.	58,416.21	59,990.72	62,288.91	63,896.48	61,148.08
17.	Cultivator	6,543.17	6,800.54	7,095.66	7,523.03	6,990.60
18.	Baler, Pull Type	7,181.22	7,602.20	7,807.66	7,969.54	7,640.16
19.	Double Disc	6,133.83	6,108.72	6,411.49	6,652.86	6,326.73
20.	Truck	7,441.20	7,443.42	7,519.58	7,849.27	7,563.37
21.	Calf Starter Supplement	6.74	6.70	6.77	7.26	6.87
22.	Dairy Supplement	6.55	6.72	6.79	7.19	6.81
23.	Hog Concentrate	10.13	10.09	10.22	10.99	10.36
24.	Poultry Concentrate	9.26	9.30	9.47	10.05	9.52
25.	Cattle Mineral	11.70	12.64	12.98	13.29	12.65
26.	Feed Barley, No. 1	2.17	2.19	2.52	2.73	2.40
27.	Hay	61.41	62.78	73.03	73.60	67.71
28.	Fertilizer 34-0-0	166.75	177.15	178.11	179.28	175.32
29.	Fertilizer 11-48-0	280.09	299.44	303.43	311.30	298.57
30.	2, 4-D, Low Volatile	82.42	95.61	100.16	100.38	94.64
31.	Avadex BW	117.46	120.08	124.82	134.10	124.11
32.	Penicillin	5.48	5.42	5.40	5.31	5.40
33.	Vitamin A D E	4.60	4.56	4.63	4.71	4.62
34.	Tetracycline	5.80	5.82	5.96	6.05	5.91
35.	Seed, Wheat	7.60	7.66	7.66	7.80	7.68
36.	Seed, Barley	6.21	6.22	6.25	6.38	6.27
37.	Purple Gasoline	65.58	69.34	71.54	83.62	72.52
38.	Diesel Fuel	63.41	67.70	70.08	82.04	70.81
39.	Propane	46.24	48.16	48.82	56.17	49.85
40.	Natural Gas	1.53	1.54	1.56	1.87	1.63

Source: Alberta Agriculture 1981d.

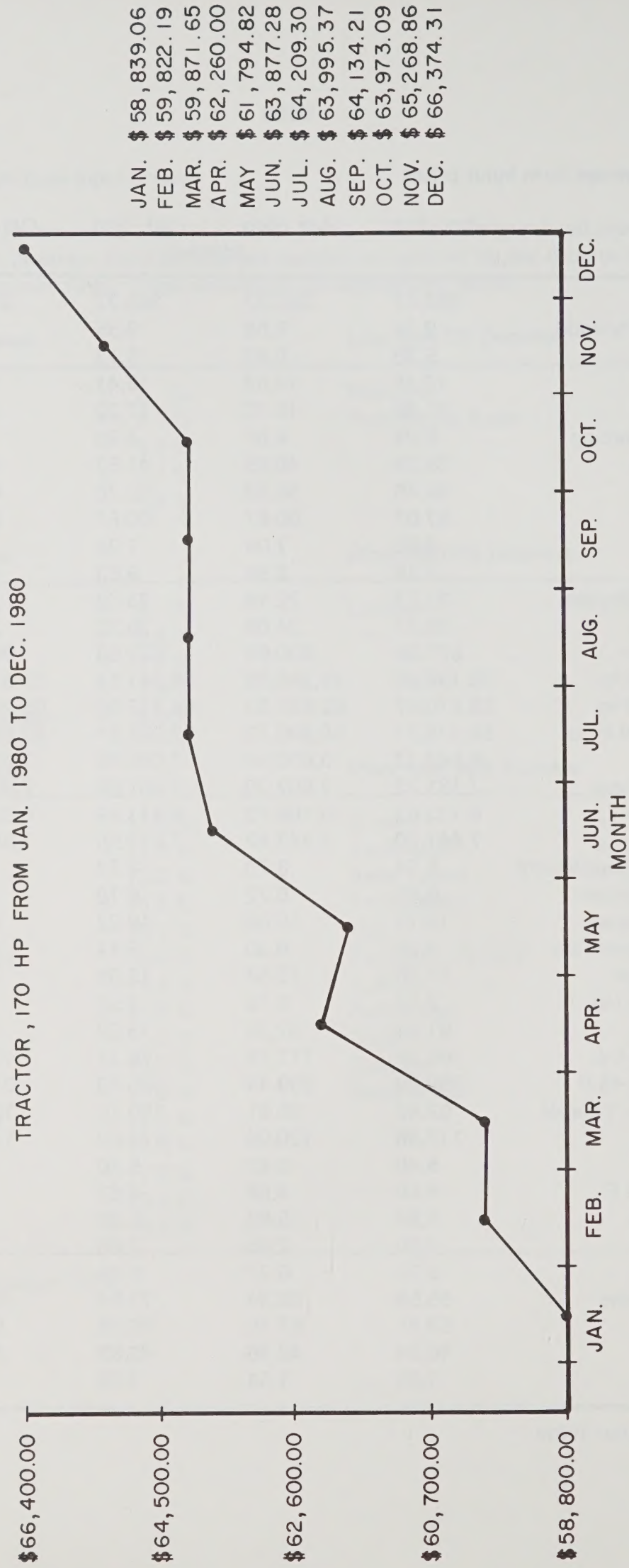


Figure A-1. Alberta Farm Input Prices - Tractor

Source: Alberta Agriculture 1981d

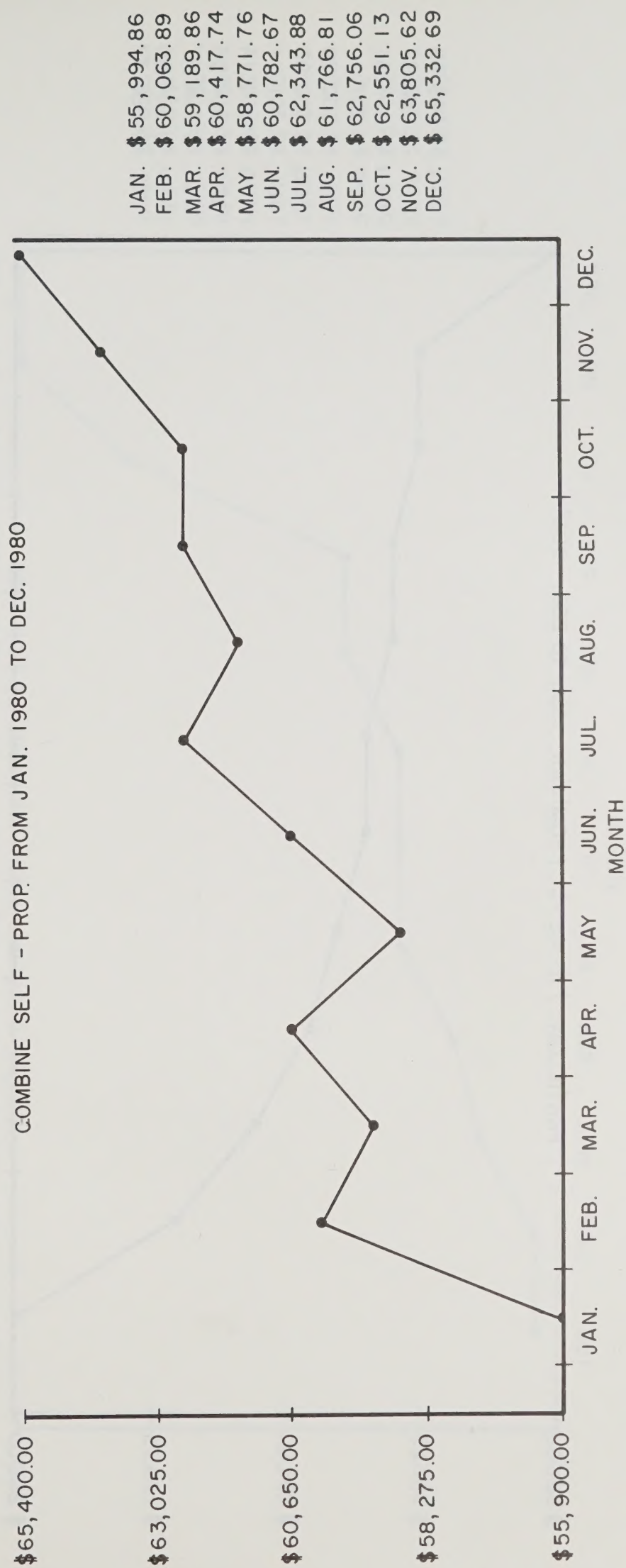


Figure A-2. Alberta Farm Input Prices - Combine

Source: Alberta Agriculture 1981d

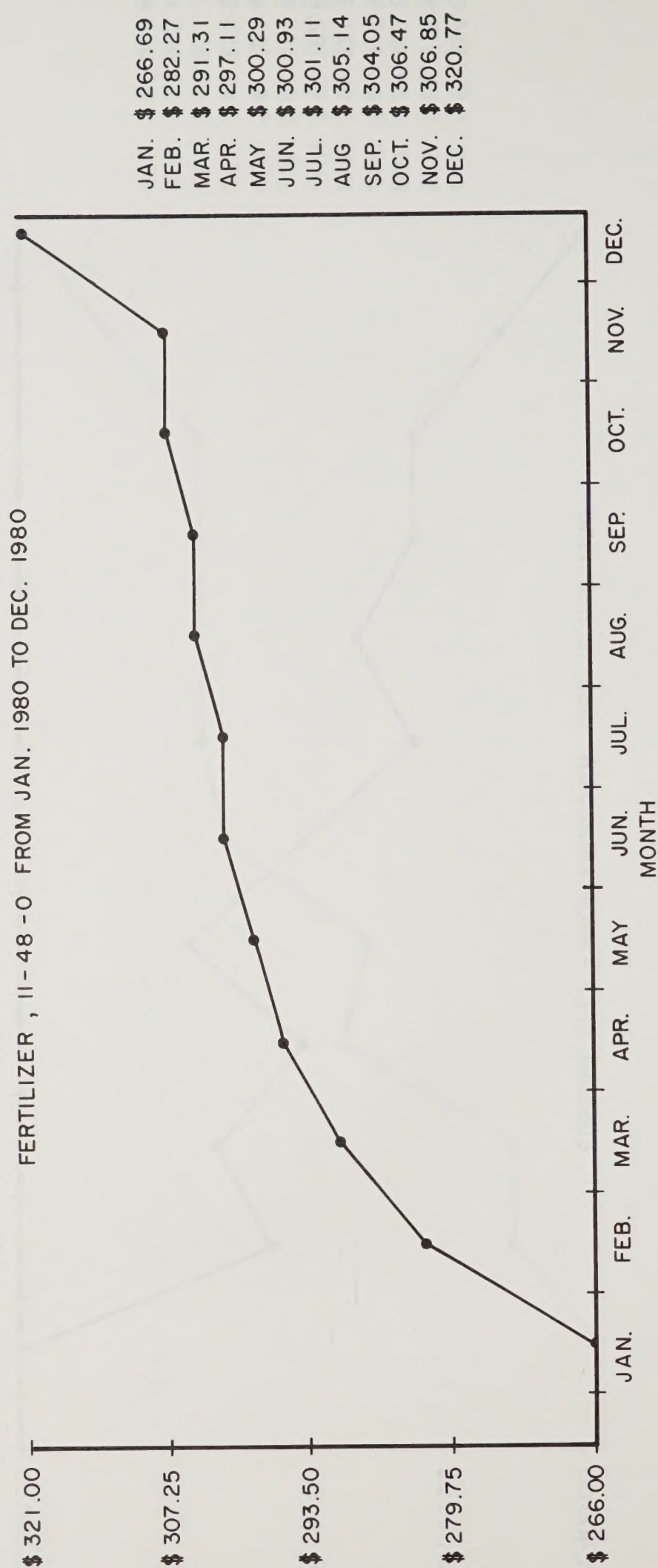


Figure A-3. Alberta Farm Input Prices - Fertilizer

Source: Alberta Agriculture 1981d

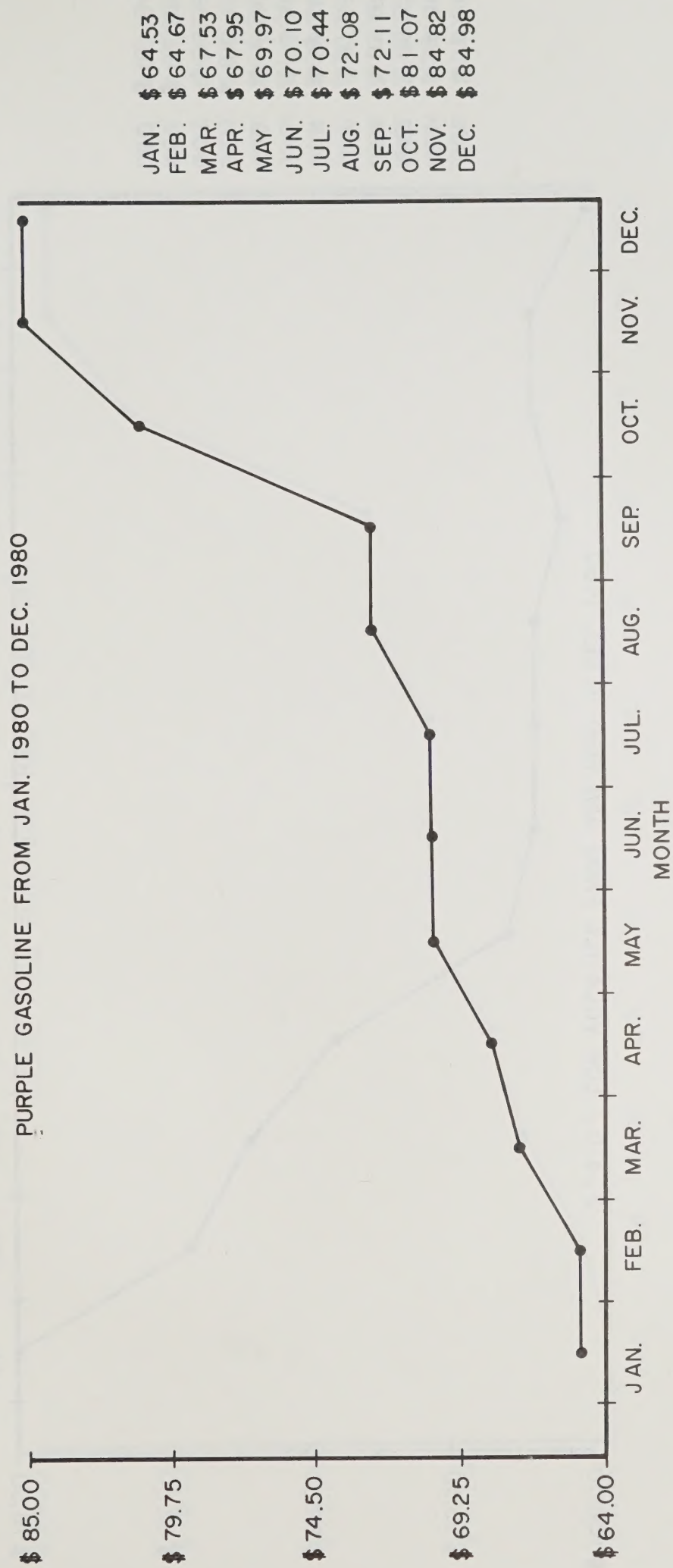


Figure A-4. Alberta Farm Input Prices - Purple Gasoline

Source: Alberta Agriculture 1981d

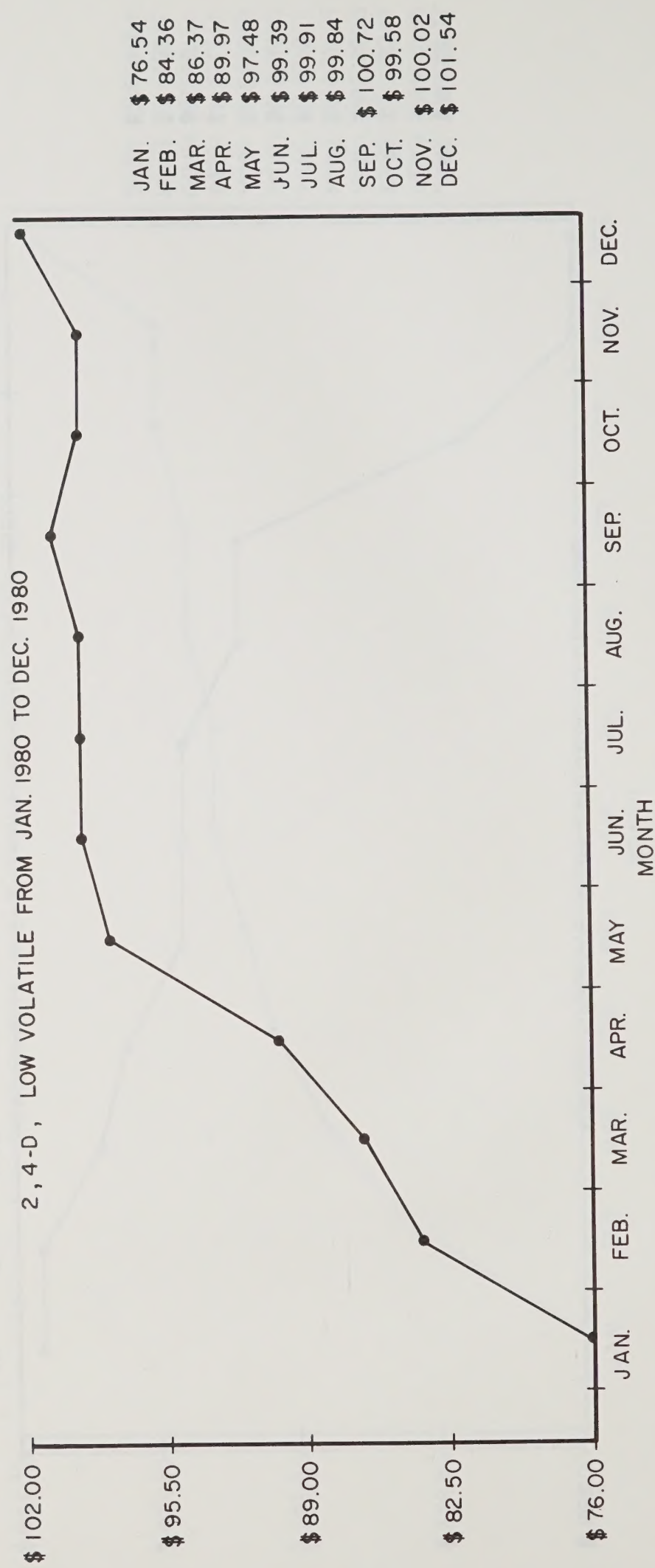


Figure A-5. Alberta Farm Input Prices - 2, 4-D

Source: Alberta Agriculture 1981d

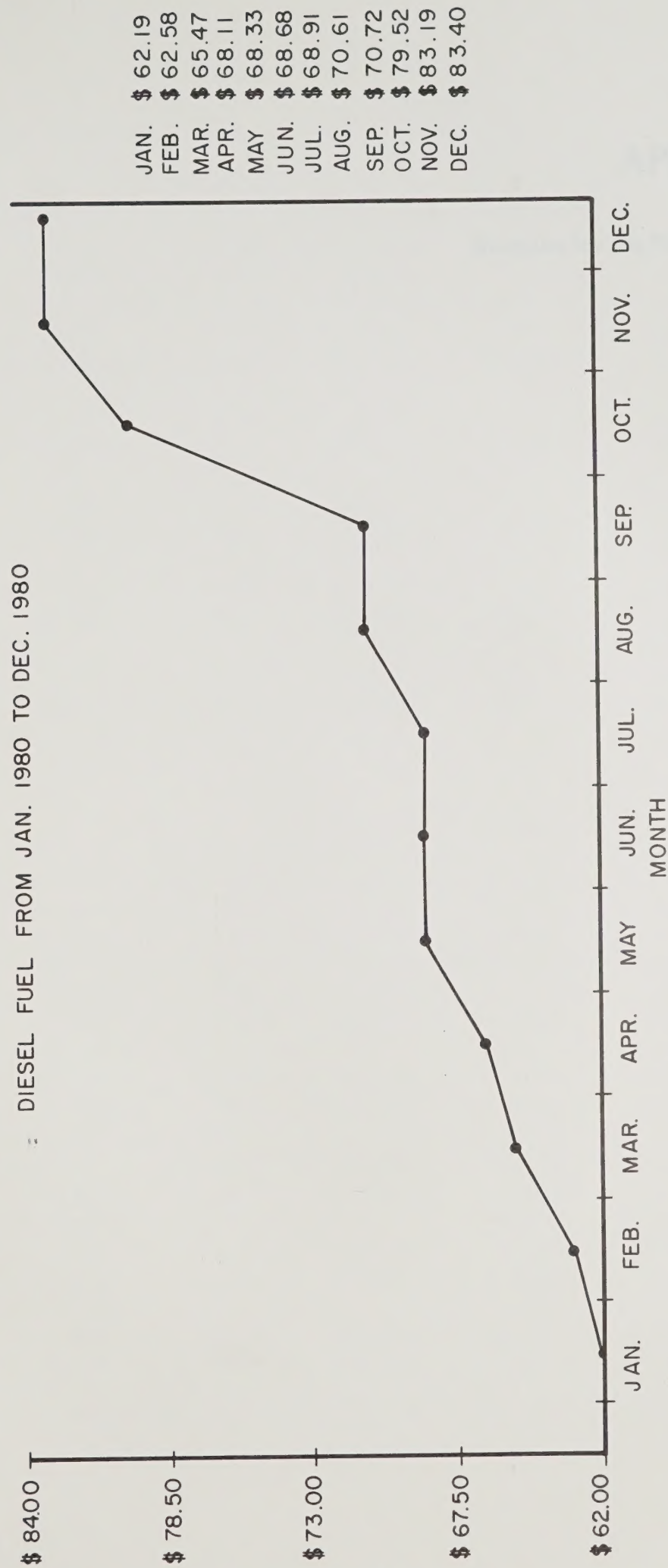


Figure A-6. Alberta Farm Input Prices - Diesel Fuel

Source: Alberta Agriculture 1981d

APPENDIX B

Statistics for the Peace River District

Table B-1. Production of principal crops

Year	Area	All Wheat			Oats for Grain		
		Area '000 ac.	Yield bu.	Production '000 bu.	Area '000 ac.	Yield bu.	Production '000 bu.
1976	Peace River	377	33.0	12,456	164	59.2	9,702
	Alberta	5,600	32.5	182,000	1,800	58.5	106,000
1977	Peace River	277	27.7	7,661	123	56.7	6,974
	Alberta	4,800	24.8	119,000	1,550	58.1	90,000
1978	Peace River	338	27.5	9,301	124	48.2	5,979
	Alberta	5,100	29.8	152,000	1,450	52.4	76,000
1979	Peace River	318	33.6	10,669	90	60.8	5,475
	Alberta	5,200	28.5	148,000	1,250	58.4	73,000
1980	Peace River	643	31.4	20,162	111	58.7	6,512
	Alberta	5,900	33.2	196,000	1,300	63.1	82,000

Year	Area	Barley for Grain			Fall Rye		
		Area '000 ac.	Yield bu.	Production '000 bu.	Area '000 ac.	Yield bu.	Production '000 bu.
1976	Peace River	1,112	39.6	44,059	3.1	28.8	89.4
	Alberta	5,550	45.4	252,000	160.0	29.4	4,700.0
1977	Peace River	846	35.9	30,378	3.7	25.4	93.8
	Alberta	5,450	45.9	250,000	175.0	25.7	4,500.0
1978	Peace River	872	34.3	29,946	4.8	25.4	122.0
	Alberta	5,050	45.1	228,000	230.0	35.7	8,200.0
1979	Peace River	710	41.9	29,754	4.3	26.9	115.7
	Alberta	4,550	45.9	209,000	230.0	27.8	6,400.0
1980	Peace River	870	41.7	36,260	4.2	26.1	109.5
	Alberta	5,350	50.3	269,000	230.0	29.6	6,800.0

Table B-1. Production of principal crops (continued)

Year	Area	Spring Rye			Rapeseed		
		Area '000 ac.	Yield bu.	Production '000 bu.	Area '000 ac.	Yield bu.	Production '000 bu.
1976	Peace River	.3	20.7	6.2	303.6	14.2	4,986.4
	Alberta	24.0	20.8	500.0	750.0	19.7	14,800.0
1977	Peace River	.5	19.8	9.9	485.4	17.0	8,271.5
	Alberta	25.0	20.0	500.0	1,550.0	22.9	35,500.0
1978	Peace River	.4	18.0	7.2	956.4	18.3	17,523.6
	Alberta	20.0	30.0	600.0	2,950.0	21.0	62,000.0
1979	Peace River	.4	25.2	10.1	1,161.7	15.3	17,747.4
	Alberta	20.0	25.0	500.0	3,500.0	18.1	63,500.0
1980	Peace River	.4	26.2	10.5	712.8	20.0	14,254.9
	Alberta	20.0	25.0	500.0	2,200.0	22.7	50,000.0

Year	Area	Flaxseed			Tame Hay		
		Area '000 ac.	Yield bu.	Production '000 bu.	Area '000 ac.	Yield Tons	Production '000 Tons
1976	Peace River	15.1	12.4	187.7	583.5	1.83	1,065.7
	Alberta	75.0	16.0	1,200.0	3,800.0	1.63	6,200.0
1977	Peace River	16.5	12.5	206.9	620.4	2.01	1,247.4
	Alberta	120.0	15.8	1,900.0	3,700.0	1.73	6,400.0
1978	Peace River	11.9	12.2	145.7	577.5	1.54	892.0
	Alberta	100.0	20.0	2,000.0	3,600.0	2.06	7,400.0
1979	Peace River	24.8	14.7	364.7	528.2	1.96	1,036.4
	Alberta	250.0	17.6	4,400.0	3,600.0	1.92	6,900.0
1980	Peace River	42.1	14.1	594.5	643.1	1.44	923.5
	Alberta	170.0	19.4	3,300.0	3,700.0	1.76	6,500.0

Source: Alberta Agriculture, Statistics Branch. Table compiled from *November Estimates of Production, Principal Crops, Alberta* for the years 1976-80.

Table B-2. Acreage in summerfallow

Year	Area	Estimated Area of Summerfallow ('000 ac.)	% of Previous Year
1978	Peace River	877	n.a.
	Alberta	6,300	n.a.
1979	Peace River	880	100.3
	Alberta	6,400	101.6
1980	Peace River	708	80.4
	Alberta	5,900	92.2
1981*	Peace River	575	81.2
	Alberta	5,100	86.4

*Preliminary estimate

Source: Alberta Agriculture, Statistics Branch. Table compiled from *November Estimates of Production, Principal Crops, Alberta* for the years 1976-80.

Table B-3. Number of cattle and calves

Year	Area	Total Cattle and Calves	% of Previous Year
1978	Peace River	178.5	n.a.
	Alberta	3,857.0	n.a.
1979	Peace River	164.3	92.0
	Alberta	3,703.0	96.0
1980	Peace River	163.2	99.3
	Alberta	3,728.0	100.7
1981	Peace River	159.8	97.9
	Alberta	3,695.0	99.1

Source: Alberta Agriculture, Statistics Branch. Table compiled from *Estimated Number of Cattle on Farms in Alberta by Census Division, January 1* for the years 1978-81.

Table B-4. Number of pigs

Year	Area	Total Pigs	% of Previous Year
1977	Peace River	46,000	n.a.
	Alberta	966,000	n.a.
1978	Peace River	44,900	97.6
	Alberta	990,000	102.5
1979	Peace River	48,000	106.9
	Alberta	1,035,000	104.5
1980	Peace River	47,500	99.0
	Alberta	1,305,000	126.1
1981	Peace River	44,400	93.5
	Alberta	1,280,000	98.1

Source: Alberta Agriculture, Statistics Branch. Table compiled from *Estimated Number of Hogs on Farms in Alberta by Census Division, January 1* for the years 1977-81.

Table B-5. 1980 average farm input prices

		Alberta	Peace River	Difference Between	
		(dollars)		Peace River & Alberta	
1.	Lumber	356.16	361.72	+	5.56
2.	Sheathing, Plywood	9.65	10.30	+	.65
3.	Cement	5.63	6.53	+	.90
4.	Paint	14.84	13.70	-	1.14
5.	Pipe, Plastic	16.89	16.32	-	.57
6.	Rods, Reinforcing	4.91	5.11	+	.20
7.	Barbed Wire	41.34	39.25	-	2.09
8.	Truck Tires	57.68	57.10	-	.58
9.	Batteries	60.03	60.83	+	.80
10.	V-belts	7.09	8.45	+	1.36
11.	Antifreeze	9.32	9.68	+	.36
12.	Mechanical Repairs	22.41	25.41	+	3.00
13.	Baler Twine	24.33	24.84	+	.51
14.	Farm Labour	909.71	849.09	-	60.62
15.	Tractor, 100 hp	37,883.96	35,747.04	-	2,136.92
15. 1	Tractor, 170 hp	62,868.35	65,184.54	+	2,316.19
16.	Combine Self-Propelled	61,148.08	57,404.70	-	3,743.38
17.	Cultivator	6,990.60	6,558.29	-	432.31
18.	Baler, Pull Type	7,640.16	7,327.09	-	313.07
19.	Double Disc	6,326.73	5,576.18	-	750.55
20.	Truck	7,563.37	7,451.31	-	112.06
21.	Calf Starter Supplement	6.87	6.96	+	.09
22.	Dairy Supplement	6.81	7.29	+	.48
23.	Hog Concentrate	10.36	11.56	+	1.20
24.	Poultry Concentrate	9.52	10.04	+	.52
25.	Cattle Mineral	12.65	11.99	-	.66
26.	Feed Barley, No. 1	2.40	2.31	-	.09
27.	Hay	67.71	52.35	-	15.36
28.	Fertilizer, 34-0-0	175.32	177.72	+	2.40
29.	Fertilizer, 11-48-0	298.57	304.57	+	6.00
30.	2, 4-D, Low Volatile	94.64	95.97	+	1.33
31.	Avadex BW	124.11	124.16	+	.05
32.	Penicillin	5.40	5.47	+	.07
33.	Vitamin A, D, E	4.62	4.90	+	.28
34.	Tetracycline	5.91	6.67	+	.76
35.	Seed, Wheat	7.68	7.71	+	.03
36.	Seed, Barley	6.27	6.22	-	.05
37.	Purple Gasoline	72.52	74.73	+	2.21
38.	Diesel Fuel	70.81	73.00	+	2.19
39.	Propane	49.85	53.38	+	3.53
40.	Natural Gas	1.63	1.72	+	.09

Source:

1. Alberta Agriculture, 1981d.

2. Alberta Agriculture, Statistics Branch. *Average Farm Input Prices by Agriculture Region for January to December, 1980*. Unpublished data.

Table B-6. Land area and utilization of provincial grazing reserves in the Peace River region

Grazing Reserve	Total Area (acres)	Developed Area* (acres)	A.U.M.s** Utilized (no.)	Patrons (no.)
Bear Canyon [†]	20,681	1,504	-	-
Blueberry Mountain [†]	9,304	-	-	-
Kleskun Lake	12,800	5,500	6,770	62
Valleyview	13,100	6,412	1,299	11
Wanham	18,735	11,300	6,350	53
Total Grande Prairie Reserves	74,620	24,716	14,419	126
Fort Vermilion [†]	19,065	2,101	-	-
High Prairie [†]	28,044	-	-	-
Manning [†]	9,600	-	-	-
Three Creeks [†]	50,000 ^{††}	-	-	-
Whitemud	24,160	9,999	5,408	37
Total Peace River Reserves	130,869	12,100	5,408	37

* Area cleared, worked down, seeded.

** A.U.M. (Animal Unit Month) is forage provided for one animal unit (one mature cow with calf or their equivalent) for one month. Statistics include sheep and horses.

[†] Grazing reserves not yet operational.

^{††} Estimated area: boundaries not finalized.

Source: Alberta Energy and Natural Resources 1980: Adapted from Table 36.

CA20NEV 82E21

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THE ECONOMICS OF AGRICULTURE IN ALBERTA
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